HANDBOOK

FOR

2·5-INCH R.M.L. STEEL (JOINTED) GUN.

MULE AND CAMEL EQUIPMENT.

1888.

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PLATES.

NOTE.—This handbook is corrected up to July, 1888. Any alterations which may be suggested should be forwarded to Director of Artillery Department, Woolwich.

MARK I GUN.

(*List of Changes*, § 3797.)

Plate I.

Material			steel.
Weight of gun	breech portion, 201 lb.		400 lb.
	chase „ 199 lb.		
Preponderance...			16 lb.
Length of gun			70·45 inches.
„	breech portion		25·7 inches.
„	muzzle		45·5 inches.
„	bore		66·5 inches.
Calibre ...			2·5 inches.
Chamber	diameter		2·56 inches.
	length		11·07 inches.
	capacity		54 cubic inches.
Rifling	Grooves: number		8
	Grooves: width		0·50 inch.
	Grooves: depth		0·05 inch.
	Twist	increasing from 1 turn in 80 calibres at breech, to 1 turn in 30 calibres, at 3·53 inches from muzzle, the remainder uniform, 1 turn in 30 calibres.	
	Length		54·73 inches.

The gun consists of two portions, the breech and the chase. The breech is formed out of a solid block of steel, and at the front end has a screw cut on the exterior to receive the junction-nut. The chase consists of two parts—a steel chase and a junction-nut (which is also the trunnion piece), having a screw cut on the inside; this nut turns freely on the exterior surface of the chase, but is prevented from coming off in front by the sight ring, which is protected by a leather protecting ring in the case of those guns which have the ring secured by fixing screws; and in rear by a shoulder; the sight ring is attached to the chase by screwing on; the chase has a muzzle swell to increase the strength. A slot is cut in the front end of the breech for the reception of a feather on the chase, to ensure the grooves of the rifling coming accurately together. A gas-ring is introduced at the joint to prevent any escape of gas; this ring should never be removed unless it is absolutely necessary: it is retained in position by a steel split ring. The union of the two portions of the gun is effected by placing them together, fitting the feather to the slot, and screwing the junction-nut to the breech; the direction in which the junction-nut should revolve is indicated by the words "tighten" and "slacken," stamped above the trunnions; the junction-nut is home when the line on its rear face accords with a similar line on the top of the breech. When the index line on the nut is to the left of the breech line, the screw is not home, and in this position the gun should not be fired except in a case of emergency, and not even then if the index lines are more than a quarter of an inch apart. When the gun is fired with the lines in this position, they must be carefully observed after each round to see that the junction-nut is not working loose. When the index line on the nut is to the right of that on the breech, no precaution is needed. In every case when the index lines do not coincide, the

angle of the sight will be affected. In cases of emergency the gun may be fired without a gas-ring.

Gas escape holes are drilled through the junction-nut concentric with the axis of the trunnions.

In cleaning the parts of the junction, a rag and oil only should be used, and never any sand or gritty substance.

Every care should be taken to keep the screws, faces, slot, and groove in the gas-ring free from dirt, rust, and burrs.

In putting the gun together attention to the following points is necessary; that—

1. The parts of junction are clean.
2. The gas-ring is in its proper place, and held by retaining ring.
3. The feather fits into the slot.
4. Both portions are held vertical.
5. The two portions are brought together without a blow.
6. The nut is screwed home by hand as far as possible.
7. The trunnion-guard is on before setting home the junction-nut with the hammer.
8. The index lines coincide when the nut is screwed home.

The gun is vented vertically, 5·25 inches from end of bore.

At the entrance to the powder-chamber, which is of greater diameter than the rest of the bore, there is a contraction or "choke," to ensure the projectile being always rammed to a definite point.

MARK II GUN.

(*List of Changes*, § 5027.)

Mark II. gun is similar to Mark I. with the following exceptions:—

The lines for indicating the position to which the junction-nut should be screwed up are engraved both on the breech and muzzle portions of the gun, with corresponding lines on the nut.

The words "Tighten" and "Slacken" are stamped respectively above and below the shoulder of the right trunnion, and *vice versâ* on the left.

The gas-rings are not interchangeable with those of Mark I., but differently shaped.

The weight, calibre, and preponderance are stamped on the right trunnion.

Gas escape-holes are drilled through the junction-nut concentric with the axis of the trunnions.

The copper vent bushes are of the same diameter and have the same pitch of screw thread as those of the Mark I. gun, but differ in having their inner ends cylindrical instead of conical.

The implements for this gun, with the exception of the block dismounting, are interchangeable.

SIGHTS.

(*Plate II.*)

The gun is provided with two sets of sights, the tangent scale sights which drop into blocks forged solid into the breech of the gun, and the foresights which are attached to the sight ring in advance of the trunnions.

The tangent sight has a steel bar, graduated up to 15 degrees, and furnished with yard and fuze scale, the deflecting leaf having a notch

for rough laying, and a small hole beneath for fine sighting. The movable clamp is fitted with nut and screw for fine readings of elevation. The correctional angle for drift is 1 degree. The foresights each consist of a metal stem, having a head furnished with an acorn-point for rough laying, and a circular frame with diagonal blades for fine sighting. The lower portion of the stem has a coarsely pitched screw cut upon it, agreeing with a nut in the sight ring. The sights are secured in their sockets by drop-sheaths; preserving screws are issued for the sockets.

The following sights are issued with the gun :—

Tangent scale	2
Fore	2

Each gun is also provided with a special tangent sight, with clamp and reciprocating bracket, which fits into the ordinary tangent sight socket. This arrangement admits of compensation in laying the gun should the axis of the trunnions not be horizontal, or should the junction-nut not be properly screwed up.

On the rear face of the bracket is pivoted a socket provided with a spirit level and a pinion gearing with a rack on the bracket.

The socket carries the special tangent sight, which can thus be adjusted into a vertical position and secured by means of a clamp fitted on the pinion. The bracket may be used with either Mark I. or II. gun, and on either side of the gun.

The sights for Mark II. gun are interchangeable with those for Mark I. when used in sets of tangent and foresight, but the line of sight is slightly lower.

The former may be distinguished by having "Sir W. Armstrong & Co." stamped on the deflection leaves.

CARRIAGE, MOUNTAIN, MARK II.

(Plate III.)

The carriage consists of two bracket sides of plate steel, connected by three steel transoms and a steel shoe-plate. The brackets are flanged outwards and strengthened by angle iron riveted beneath the top flanges. Steel castings fixed at the front, form bearings for the trunnions of the gun, and the axletree. The shoe-plate has a socket in it for the traversing handspike, which is arranged with a bayonet-joint to hold the handspike when shipped.

A metal hook is riveted on the top of the shoe-plate, round which the recoil check-rope passes, a metal plate being attached to each bracket-flange to save the rope from being chafed. The carriage is fitted with two spanners for tightening the axletree clip-bolts, and a leather socket for the priming irons. It has two stops on the underside to keep the trail in position when carried on its cradle. The axletree is of wrought iron, with special arms. It is secured to the trail by clip-plates and bolts.

The wheels are 3 feet in diameter, with 2⅜-inch ring tire, and metal naves. The dismounting block is of malleable cast iron, with a triangular base, and can be used on the ground apart from the carriage. It can also be placed between the guides provided on the trail of the carriage, and used in that position.

The elevating gear consists of a steel bed of ⊤ iron, the front of which hooks loosely on a cross bar on the carriage. It has in the centre a cross bar, the ends of which rest in notched racks riveted to

the brackets. A sliding metal coin is attached to the stool bed by clips. The gear is worked by a hand wheel which turns a screw working through the coin. On its upper surface, to act as a cushion, is a wooden cap, attached to the coin by a key.

Check Rope.

A single check rope of 2½-inch white rope 7 feet 2 inches long, is used to check the recoil. It has a hook at each end, by which it is hooked on itself, after being passed round a felloe of each wheel, the middle of the rope being passed under the hook on the trail. When limbered up the hooks of the check rope are hooked to the rings of the capsquare key chain, the middle being passed under the hook on the trail.

Handspike.

With the above carriage a straight wooden handspike is used, at the side of which there is a stud to suit the bayonet joint socket on the trail.

Measurements and Tonnage.

		ft.	in.
Height of axis of gun		2	1·75
Track of wheels		3	0

Elevation, maximum		25°
Depression, maximum, by bed and coin	...	15°

			cwt.	qrs.	lbs.
Weight	carriage body, with axletree and elevating arrangement	...	2	3	16
	wheels (two)	...	1	3	19

			Tons.
Tonnage	for shipment	...	0·506
	for transport in boats ...	...	1·836

Rectangular space occupied in boats 6 ft. 10 ins. × 3 ft. 7 ins. × 3 ft.

PROJECTILES.

(*Plates IV. and V.*)

- Shell
  - Common, cast iron, Marks I., I.*, and II.—*List of Changes*, § 3800 and 5031.
  - Shrapnel, steel, Marks I., I.*, II., and III.—*List of Changes*, § 4142, 5031, and 5183.
  - Star
    - Armstrong, Mark I.—*List of Changes*, § 4692.
    - R.L., Mark II.—*List of Changes*, § 4693.
- Shot, case, Marks I. and I*.—*List of Changes*, § 3801 and 5183.

The shells, except the star shell, are without studs, the rotation being effected by the gas-check, which is made of copper. The gas-checks are issued spun on to the shells. The G.S. wad for fuze-hole, § 2075, is inserted in common shell, Mark II., and shrapnel shell, Mark III., when filled.

All the above shell have a fuze-hole of G.S. gauge.

DESCRIPTION OF PROJECTILES.

Common Shell, Mark II.

(Plate IV.)

The exterior is unturned, being cast to the figured dimensions.

The gas-checks are spun on, and become firmly fixed to the base of the shell on firing.

Diameter over body		2·47 ins. ± ·01 in.
Length of shell	without gas-check ...	7·925 ins. ± ·066 in.
	with gas-check ...	7·985 ins. ± ·066 in.

		lb.	oz.
Weight	shell	6	10
	gas-check, Mark II. ...	0	6
	bursting charge ...	0	4
	fuze	0	6
	Total ± 1·5 per cent. ...	7	10

The dimensions of Mark I common shell are the same as Mark II., but Mark II. has the fuze-hole long enough to take the G.S. wad under the fuze. The latter also takes Mark II. gas-check.

The weights differ slightly.

		lb.	oz.
Weight	shell	6	7¾
	gas-check, Mark I.	0	4¼
	bursting charge ...	0	4
	fuze	0	6
	Total ± 1·5 per cent. ...	7	6

Some shells of Mark I.* exist, but differ only in the number of serrations on the base, and therefore can only be used with their own gas-checks.

Shrapnel Shell.

(Plate V.)

This shell differs from the Boxer shrapnel for rifled guns in having the bursting charge in the head instead of at the rear end, the whole of the body of the shell being filled with mixed metal bullets, with the exception of a ring of iron segments which rest on the base end as shown in the Plate.

The cylindrical portion of the shell is made of steel, and the head and base of malleable cast iron. The head is screwed into the upper part of the body, and the base is attached to the body by rivets, two twisting keys serving to prevent it twisting off; the bullets, the interstices between which are filled with rosin, are covered and secured at the top by a disc of tin to separate them from the bursting charge.

When the bursting charge ignites the base of the shell is blown off and the bullets are liberated, the head and body generally passing on intact.

Mark I. contained 98 bullets, 35 to the lb., and 10 cast-iron segments. Only a few were supplied by contract.

Mark I.* is of Elswick manufacture, and differs from Mark I. in having a steel head and body in one piece, and a cylindrical tin powder chamber in the head. Its contents are 77 mixed metal balls, 16 to the lb., and 3 of 34 to the lb. with no iron segments. Having a different

number of servations on the base to other patterns, Mark I.* can only be used with its own gas-check.

Mark II. is similar to I., but contains 100 bullets, 35 to the lb., 70 buck-shot, and 10 cast-iron segments.

Mark III. has a deeper socket to take the G.S. wad under the fuze, and those of later manufacture have the tin disc soldered to the head. It contains 100 mixed metal balls, 35 to the lb., 11 buck-shot, and 10 cast-iron segments.

Marks I. and II. have their bursting charge in flat circular shalloon bags; Mark I.* has a cylindrical bag; and Mark III. has the bursting charge put in loose, a G.S. wad being inserted under the fuze.

Their dimensions are as follows:—

Mark.	Length with gas-check.	Diameter.	Weight.				
			Shell empty.	Gas-check.'	Burster.	Fuze.	Total.
	inches.	inches.	lbs oz.	oz.	oz.	oz.	lbs. oz.
I	6·96 ± ·06	2·47 ± ·01	7 2¼	4¼	½	10	8 1
I*	„	„	6 11¼	4¼	½	10	7 10
II	„	„	6 11¼	4¼	½	10	7 10
III	„	„	6 9½	6†	½	10	7 10

† Mark II.

Star Shell, Armstrong, Mark I.

A number of shells of this description have been issued for service, but it is not intended that more of this pattern should be made.

The body is made of steel, 0·19 inch thick in the rear half, and 0·125 inch thick in front. It is riveted to a base of wrought iron.

The base is recessed on the inside to form a chamber for the reception of the bursting charge, covered by a diaphragm of iron plate, No. 17 B.W.G.

The bursting charge consists of ½ dram of R.F.G. powder, contained in a red shalloon bag, through which four strands of quickmatch are threaded, and then brought through a small hole in the centre of the diaphragm, and led up the centre of the shell to the fuze-hole.

The head is made of wood, covered with XXX D-tin plate, lightly attached to the body by three copper pins, No. 13 B.W.G. It is fitted with a fuze socket of gun-metal, general service gauge.

The shell is without a gas-check; it is rotated by means of four copper studs attached to the body near the base. It contains 11 stars, and the bottom of the fuze-hole is closed by a disc of red shalloon placed over the stars and quickmatch. The stars are paper cylinders filled with composition and bound with quickmatch; they burn about 18 secs.

		in.
Diameter over body		2·47
„ „ studs		2·56
Length		7·0
	lb.	oz.
Weight, with fuze, about	3	12

The maximum charge with which this shell should be fired is 4 ozs. of R.L.G.², R.L.G. or L.G. powder, as the shock, when higher charges are used, is liable to break the stars.

These shells are painted black and varnished, and have the fuze-hole plugs luted in, so as to exclude the damp as much as possible. They are packed four in a wooden box, painted inside with red lead, and the cover fitted with strips of felt to protect them further from the damp. They should not be removed from the boxes until they are required for use.

The fuze key serves also to unscrew the fuze-hole plug.

Star Shell, R.L., Mark II.

(Plate V.)

The body is made of steel tubing 0·1875 inch thick, screwed at the bottom end to receive the base.

The base is made of malleable cast iron, hollowed out in the interior, as shown in the Plate; the recess contains a blowing charge consisting of quickmatch sewn on to a disc of paper, and is covered by a wrought-iron disc 0·1 inch in thickness.

The head consists of a wood block covered with tinned sheet iron, and fitted with a gun-metal socket which communicates, by means of a small brass tube, with the blowing charge, through the diaphragm. The socket, tube, and diaphragm are perforated with several small holes, thus affording direct communication from the flash of the fuze to the stars and the blowing charge.

The shell is without a gas-check, and is rotated by means of four copper studs attached to the body near the base. It contains 20 stars, 10 large and 10 small. The time of burning of the stars, after being ejected from the shell, is from about 15 to 20 seconds.

	in.		in.
Diameter over body	2·47	±	0·01
" " studs	2·57	±	0·005
Length...	10·25	±	0·1
	lb. oz.		oz.
Weight (complete)	5 13	±	3

A few shells, Mark I., Royal Laboratory manufacture (not published in *List of Changes*), have been issued. They differ from Mark II. in having (1) the base made of gun-metal and rounded, (2) four projections on the base instead of four studs on the body, and (3), a larger chamber for the bursting charge.

Case Shot, Marks I. and I.*

(Plate IV.)

The body, or outer case, is made of XX single tin, the sides being in three parts, soldered together longitudinally.

The sides of the case are lined with three longitudinal segments of sheet iron, 0·109 inch, and the base is strengthened by a ring of sheet iron, 0·109 inch, riveted on outside, and a disc of sheet iron, 0·109 inch, laid in loose inside. The top is a disc of sheet iron, 0·049 inch, fitted to the case by notching and turning over the tin ends of the case, to which it is soldered.

The case contains 159 mixed metal balls, 34 to the lb. The interstices are filled with a mixture of half sand, half clay.

Length of case		6·6 inch ± ·055 inch.
Diameter ...		2·46 inch ± ·015 inch.
Total weight		6 lb. 12 oz. ± 4 oz.

Mark I.* case shot differs from Mark I. in being ·25 inch longer, and also in the contents, which are—

77 mixed metal balls	16 per lb.
3 " " "	34 per lb.

They are marked on the base $\frac{\text{I*}}{\text{E.O.C.}}$

FUZES.

(Plates VI. and VII.)

Percussion small, Mark I.,* No. 8.

Time —
- Time and percussion, short, No. 55, for common and Shrapnel shell.
- Armstrong, small, time and concussion, with thin suspending wire and concussion arrangement removed, for Armstrong star shell.
- Wood, M.L., 15 seconds, with special priming, No. 42, for R.L. star shell.

DESCRIPTION OF FUZES.

Percussion, Small, Mark I.*

(Plate VIII.)

The fuze, which is tapped on the exterior to the G.S. pitch and taper, consists of the following parts:—Body; detonator pellet (*a*); safety pellet (*b*); ball (*c*); retaining bolt of gun-metal (*d*); closing pellet of lead and tin (*e*); needle of steel (*f*), with roughened point; safety pin (*g*); shearing wire (*h*), and cap of copper. The detonating composition in the latter covered with a paper disc. There is a small brass spring (*i*) to hold the retaining bolt in its place, and a small gun-metal set screw (*k*) to keep the detonator pellet from revolving independently of the body of the fuze. The detonator pellet and bottom plug contain powder.

These parts are all shown in the plate.

Action.

On shock of discharge, the safety pellet (*b*) shears its wire (*h*) and falls to the bottom of the recess shown in the plate. This allows the ball (*c*) to fall on to it into the same recess.

The rotary motion of the shell now causes the closing pellet (*e*) to move outwards and close the top of the recess, and also the retaining bolt (*d*) to overcome the force of the spring (*i*). There is now nothing to prevent the detonator pellet (*a*) moving forward on to the needle (*f*), which it does on the graze or impact of the shell, firing the cap and powder in powder channel and bottom plug, the flash then passing to bursting charge of shell.

Fuze, Time, and Percussion, Short. Mark I., No. 55.*

(Plate VI.)

The fuze is made of gun-metal, turned all over and screwed to suit G.S. fuze-hole. The interior is bored out at the lower end and fitted with a needle (*g*), detonator pellet (*n*), retaining bolt (*m*), safety pellet (*i*), and brass ball (*l*), and the bottom closed with a gun-metal screw-plug and shalloon discs. The fuze is fitted with a composition ring (*d*) made of gun-metal, with a stem containing a hammer and needle (*c*) suspended by a copper shearing wire (*b*) 0·22″ diameter over a detonator covered by a brass disc. A dome is fitted over the composition ring and secured by a cap screwed on the stem of body of fuze. The fuze has two safety-pins (*aa*), one through the safety pellet (*i*) and one through the lighting needle (*c*), each having a loop of string attached.

Action.

The fuze is screwed into the nose of shell, and the safety-pins (*aa*) withdrawn at the moment of loading. On shock of discharge the wire (*b*), through lighting needle (*c*), is sheared, and the needle (*c*) ignites the composition in ring (*d*), which burns (according to graduation) until it reaches the mealed-powder pellet (*e*), which it ignites, firing the magazine (*f*), the flash then passing through the holes in head of needle (*g*), fires the fuze.

When Used as a Percussion Fuze.

On shock of discharge the wire (*h*) is sheared, causing the safety pellet (*i*) to fall into the pocket (*k*), thus releasing the ball (*l*); the centrifugal motion then causes the retaining bolt (*m*) to fly out, releasing the detonator pellet (*n*) which, being free to move forward (on impact), strikes the point of needle (*g*), thus igniting the detonating composition and firing the fuze.

Fuze, Time, and Concussion, Small, with thin suspending wire, and concussion arrangement removed.

(Plate VI.)

This fuze is for use with the Armstrong star shell only, and is a small pattern of the Armstrong medium time and concussion fuze (§ 4219), altered as follows :—

(1.) The concussion arrangement is removed, and its place filled by a powder puff, 10 grains F.G. powder in a muslin bag.

(2.) The suspending wire of the time pellet is reduced to 0·009 inch in diameter.

Fuze, Time, Wood, M.L., 15 secs., with special Priming, No. 42.

(Plate VII.)

This fuze is for use with R.L. star shell, and only differs from the fuze, time, wood, 15 seconds, M.L., Mark II. (§ 4045), in having an additional priming of guncotton. A strand of No. 4 dry guncotton yarn, about 11 inches in length, is passed twice round the head of the fuze over the ordinary quick-match priming, and fastened with silk

twist, leaving about $1\frac{1}{2}$ inch of each end of the guncotton loose; a patch of waterproof paper is pressed down over the priming; and a band of thin copper and tape wrapped round the whole, and secured with shellac varnish.

The head of the fuze is painted red, and the loose end or tip of the copper band is painted white.

The borer is the ordinary hook-borer for wood fuzes.

INSTRUCTIONS FOR THE PREPARATION OF SHELLS AND FUZES.

(MAGAZINE REGULATIONS, 1887.)

Common Shell.

Remove the plug from the fuze-hole, insert the leather funnel and pour in the bursting charge; the shell should be tapped with a mallet or a piece of wood to ensure its being completely filled, just leaving room for the fuze. After filling the shell carefully wipe every portion of powder from the fuze-hole, then fix the fuze or plug as may be required.

In shells that are liable to be moved, or that are not required for immediate use, and in shells for use in the field, or boats in naval service, insert the wad, fuze-hole, G.S., with the side on which the shalloon is cemented downwards, *i.e.*, next the powder; drive it in with the "Drift, G.S.," as far as the shoulder on the drift will allow, and then screw in the fuze or plug, as may be required.

Shrapnel Shell.

The bursters for Marks I., I.*, and II. are contained in shalloon bags, which are filled before insertion in the shell, either service L.G. or F.G. being used.

Marks I. and II. have flat circular bags, Mark I.* a cylindrical bag to suit the chambers in the heads.

To fill a shell, remove the plug, insert the filled burster, choke down in Mark I.,* choke up in Marks I. and II., in the two latter pushing the choke down to one side, away from the fuze-hole.

In Mark III. the powder is put in loose, only service L.G. being used. To fill a shell, remove the plug, weigh out the bursting charge, place the funnel in the fuze-hole, and pour in the charge. Fix a G.S. wad in the bottom of the socket, and replace the plug.

N.B.—In all cases it should be ascertained that the chamber is dry and clean before inserting the bursting charge, whether contained in a bag or loose, and the thread of the fuze-hole should be wiped clean of grease.

Star Shell, Armstrong.

This shell does not require to be filled; it is ready to receive the fuze after the removal of the canvas cover from the top of the shell, and of the metal plug by unscrewing it.

With a charge of 4 oz. R.L.G.^{2}, R.L.G., or L.G., elevation 33 degrees, and fuze set to 4, the shell will burst after 8 seconds at a range of about 800 yards; with a charge of 2 oz., same elevation, and fuze set to 2, the shell will burst in 4 seconds at a range of about 600 yards.

Star Shell, R.L.

This shell, also, is issued filled.

Tear off the canvas cover from the top of the shell.

Unscrew and remove the metal plug.

Insert the wood time fuze very firmly in the usual manner after it has been bored to the required length.

The cartridge and shell should be rammed home simultaneously, making use of the sponge head for this purpose, care being taken that the sponge-head is thoroughly dry. (The recess in the rammer is liable to grip the head of the wood fuze.)

With a charge of 6 oz. R.L.G.[2], elevation from 15 degrees to 20 degrees, and fuze bored to 12 or 14, the stars will range from 700 to 800 yards, rendering objects distinctly visible at that distance.

NOTE.—The elevation and length of fuze must be reduced for shorter ranges to such an extent as may appear to be desirable.

A fair or contrary wind has considerable influence on the range of the stars.

Common Shell for Incendiary Purposes.

The shell to be prepared for incendiary purposes, if already filled with the bursting charge, must be emptied, and then filled up as far as possible with incendiary stars. The shell should be tilted to one side, and the stars put in gradually and occasionally "set" or shaken down, so as to bed themselves evenly together, powder being introduced from time to time to fill up spaces between the cylinders. (A small wooden stick will be found of assistance in getting the stars well in.) When no more stars can be inserted, and the shell is tightly filled, the fuze or plug will be inserted, as may be required.

Common shell will hold about six stars.

Before using a shell, it should be ascertained that there is powder close to the fuze-hole. These shells are fuzed with percussion fuzes.

*Fuze, Percussion, Small, Mark I.**

Remove the G.S. plug, insert the fuze and screw it home, using the "Key, fuze, universal," which fits two slots cut in the head of the fuze.

Remove the safety pin at the moment of loading.

Fuze, Time and Percussion, Short, No. 55.

Preparation and Fixing.

Insert the point on the semi-circular arm of the "Key, fuze, universal," in the small hole in the circumference of the body of the fuze, and screw the latter tightly into the G.S. fuze-hole.

The fuze is set after it is fixed in the shell.

To Prepare it as a Time Fuze.

Loosen the hexagonal cap on the top of the fuze by means of the slot in one of the arms of the key, which will fit over it, and then turn the dome and collar of the fuze together until the required graduation on the collar coincides with the arrow-head on the body, and tighten the cap. This should be done *before the removal of the upper safety-pin*, great care being taken that the ring is properly placed inside the seat formed by the projecting rim round the body, and that it is not tilted on one side. The nut should be screwed down as tightly as possible.

Withdrawing Safety-Pins.

If required to act as a time and percussion fuze, withdraw both safety-pins after inserting the shell in the bore; if the percussion arrangement is not required to act, the lower safety-pin should be left in; if required to act as a percussion fuze only, the upper safety-pin should not be removed, and the arrow-head should be set on bridge, that is, between 0 and 18. If the fuze is not fired the safety-pins must be replaced.

Fuzes, Time and Concussion, Small.

These fuzes consist externally of two parts—which are packed separately—the fuze proper, and the thimble by which it is ignited.

Each fuze is provided with a metal nut which clamps a metal collar on to the cylindrical portion (the body) of the fuze, which is of white metal; round this latter is marked the scale in inches and tenths, and in it is a hole for the key used to screw the fuze into the shell, or remove it.

The star shell is fuzed as follows :—

(*a.*) The fuze, without the thimble, is tightly screwed into the fuze-hole by means of the "key, fuze, universal," before the shell is brought to the gun.

(*b.*) The metal nut is unscrewed a little by hand or key, to loosen the metal collar, which is turned until the arrow-head on it is opposite the desired mark on the scale.

(*c.*) The nut is now tightened to keep the collar in this position.

(*d.*) The thimble *must not* be screwed into the top of the fuze until the moment of loading.

All the screws above-mentioned are right-handed.

Fuzes, Time, Wood, M.L., 15 secs., with special priming, No. 42.

These fuzes are fixed in the fuze-hole by screwing the fuze round by hand until it is held firmly. These fuzes are "uncapped" by taking hold of the small end (coloured white) of the band, which is left exposed, and unwinding from right to left smartly, so as to thoroughly detach the band from the head of the fuze, and to leave the priming fully exposed. The extra priming of dry guncotton should not be disturbed. The uncapping must not be done until the shell is placed in the muzzle of the gun.

CHARGES.

Nature of charge.	Weight.		Powder.	Dimensions (filled.)			Material of cartridge.	Remarks.
				Length from	to	Diameter.		
	lbs.	oz.		ins.	ins.	ins.		
Service ...	1	8	R.L.G.^{2}	10·5	11·0	2·3	Silk cloth	
" ...	1	10	R.L.G.^{4}	10·75	11·25	2·3	"	
" ...		6	R.L.G.^{2}	7·0	7·5	1·5	Shalloon	For star shell R.L. pattern only.
" ...		4 or 2	R.L.G.^{2} R.L.G., or L.G.	*		*	"	For star shell Armstrong pattern only.
Saluting ...		12	R.L.G. or L.G.	7·0	7·5	2·1	Silk cloth	

* These cartridges are of such a length as to ensure that some portion will be under the vent when loaded.

Range Table for 2·5-inch Steel R.M.L. Gun.

Based on practice of 19 and 20/12/78.

Charge,—1 lb. 8 oz. R.L.G.^{5}; or 1 lb. 10 oz. R.L.G.^{4} Muzzle velocity,—1440 f.s.
Jump,—10½ minutes.
Projectile,—Common shell or shrapnel.

Range.	Elevation.	Angle of descent.	Remaining velocity.	5 minutes' elevation increases or decreases the range by	5 minutes will alter point of impact vertically or laterally at each range.	Time of flight.	Fuze scale. Short Time and Percussion. Mark I*.	50 per cent. should fall within.		
								Length.	Breadth.	Height.
yards.	° ′	° ′	f. s.	yards.	yards.	seconds.		yds.	yds.	yds.
100			1384					20	0·1	0·1
200	0 7	0 20	1328	73·9	0·29	0·51	1·1	20	0·1	0·1
300	0 16	0 31	1279	71·0	0·43	0·75	1·6	20	0·1	0·2
400	0 25	0 43	1233	61·6	0·58	0·99	2·1	20	0·2	0·2
500	0 35	0 55	1190	59·5	0·72	1·24	2·6	20	0·3	0·3
600	0 47	1 8	1150	57·5	0·87	1·49	3·1	20	0·3	0·4
700	0 58	1 22	1114	55·6	1·01	1·74	3·6	19	0·4	0·5
800	1 9	1 37	1080	49·1	1·16	1·99	4·1	19	0·4	0·5
900	1 21	1 53	1054	43·4	1·31	2·25	4·6	19	0·5	0·6
1000	1 33	2 10	1028	42·5	1·45	2·51	5·2	19	0·6	0·7
1100	1 46	2 28	1006	38·4	1·60	2·79	5·8	19	0·6	0·8
1200	2 0	2 47	988	35·9	1·74	3·09	6·5	18	0·7	0·9
1300	2 15	3 7	970	32·4	1·89	3·39	7·2	18	0·8	1·0
1400	2 31	3 28	953	31·4	2·03	3·71	8·0	18	0·9	1·1
1500	2 47	3 51	936	30·5	2·18	4·03	8·8	18	0·9	1·2
1600	3 3	4 14	919	29·6	2·32	4·36	9·5	18	1·0	1·3
1700	3 19	4 38	902	28·7	2·47	4·70	10·2	18	1·1	1·4
1800	3 35	5 3	885	27·8	2·61	5·04	11·0	18	1·2	1·5
1900	3 52	5 28	868	26·9	2·76	5·39	11·7	18	1·3	1·7
2000	4 9	5 54	852	26·0	2·91	5·74	12·5	18	1·3	1·8
2100	4 26	6 20	837	25·1	3·05	6·10	13·2	18	1·4	1·9
2200	4 44	6 46	823	24·2	3·21	6·47	13·9	18	1·5	2·1
2300	5 2	7 13	809	23·4	3·34	6·85	14·6	18	1·7	2·2
2400	5 20	7 41	796	22·6	3·49	7·23	15·4	18	1·8	2·4
2500	5 38	8 10	783	21·8	3·63	7·62	16·2	18	1·9	2·5
2600	5 57	8 40	770	21·0	3·78	8·01	17·0	18	2·0	2·7
2700	6 17	9 11	758	20·2	3·92	8·40	17·8	18	2·2	2·9
2800	6 37	9 42	746	19·4	4·07	8·80		18	2·3	3·1
2900	6 58	10 14	735	18·6	4·21	9·20		18	2·5	3·3
3000	7 19	10 46	724	17·8	4·36	9·60		18	2·6	3·5
3100	7 40	11 20	713	17·1	4·51	10·02		19	2·8	3·7
3200	8 1	11 54	702	16·4	4·65	10·44		19	2·9	4·0
3300	8 23	12 30	691	15·7	4·80	10·87		19	3·1	4·2
3400	8 45	13 6	680	15·1	4·94	11·31		19	3·3	4·5
3500	9 7	13 43	669	14·6	5·09	11·75		19	3·4	4·7
3600	9 30	14 20	658	14·1	5·23	12·20		20	3·6	5·1
3700	9 54	14 59	647	13·5	5·38	12·66		20	3·8	5·4
3800	10 18	15 39	637	13·0	5·52	13·12		20	4·0	5·8
3900	10 43	16 21	627	12·5	5·67	13·59		20	4·2	6·2
4000	11 7	17 4	617	12·0	5·81	14·07		20	4·4	6·6

MULE EQUIPMENT.

HARNESS.

A set consists of—

Ordnance Mules.

	Weight. lbs.	oz.
1 breeching, with loin strap	3	3
1 chain, collar, G.S.	2	7
1 collar, breast, with neck strap	2	9
1 crupper, with metre strap	1	2
2 girths, web	2	12
4 straps, metre girth	2	4
2 straps, metre, surcingle	1	2
1 surcingle, web, R.M.L. 2·5-inch	0	14
1 collar, head, with ring on nose-band	1	12
1 bit, bridoon, without rein	0	14
1 rein, leather, bridoon, with iron stops...	0	10
	19	9

For relief mules, in addition to above, 2 sets of straps, line gear, large weight 4 lbs.

Baggage Mules.

	lbs.	oz.
2 sets of baggage ropes	3	4
1 breeching...	1	4
1 collar, breast	1	5
1 collar, head, with ring on nose-band	1	12
2 girths, web	1	2
1 bit, bridoon, without rein	0	14
1 rein, leather, bridoon, with iron stops...	0	10
1 chain, collar, G.S.	2	7
1 crupper	1	0
1 surcingle, G.S. Mark II., 2·5-inch	1	8
	15	2

N.B.—All mules except those of 1st line and spare carriage mules carry, in addition, 1 strap, cloak and line gear, weight 6 oz.

MULE EQUIPMENT—*continued.*

LINE GEAR.

A set consists of—	Weight. lbs.	oz.
1 blanket	8	2
1 heel rope, with 2 shackles	1	8
1 iron peg	2	8
1 wooden peg	1	4
1 surcingle, web, with pad	0	10
1 brush, horse	0	11½
1 sponge	0	0¾
1 curry comb	0	11¾
1 bag, line gear (except for horses)	0	8
1 stick, head	1	7
1 rope, head	0	12
	18	3

In addition to above, 4 baggage mules in each subdivision carry a Sack, corn, jute, 5-bushel, weight 4 lb. 8 oz.

N.B.—Each set of line gear is carried, rolled in the blanket, one set on each side of the relief ordnance and spare baggage cradles, and one on the top of ammunition artificer and baggage cradles.

The gear of the 1st line is carried on the relief line; that of the pioneer mules on the relief ammunition mules of Nos. 1, 3, and 5 subdivisions; that of the barebacked mules and forge mule on the spare baggage mules.

Nose-bags are carried hooked to front hook on near side of saddle: when two sets of line gear are carried, one on each front hook.

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING.

	Description of Mule.	Articles carried.	Weight. lb.	oz.
1st Line.	Gun chase mule.	SADDLERY.		
		1 set M.B. harness, ordnance (*vide* list)	19	9
		1 gun chase cradle	45	9
		1 pair pannels	20	7
		2 gun straps, 35 in. × 1½ in. ...	1	1
			86	10
		LOAD.		
		1 gun, chase portion	204	0
		1 trunnion sight cover	0	11
		1 leather joint cap	1	9
		2 handspikes, Mark II.	8	0
		1 pocket, with clinometer	2	0
		1 pocket, with tangent scale ...	1	12
		1 pocket, with fore-sight	0	6
		1 sight pocket strap, 41 in. × 1¼ in.	0	5
		1 muzzle tampeon	1	7
			220	2
		Total	306	12
	Gun breech mule.	SADDLERY.		
		1 set M.B. harness, ordnance (*vide* list)	19	9
		1 gun breech cradle	47	7
		1 pair pannels	20	7
		2 gun straps, 35 in. × 1½ in. ...	1	1
		1 strap, dismounting block ...	0	2
		1 strap, dismounting hammer ...	0	2
			88	12
		LOAD.		
		1 gun, breech portion	200	8
		1 gun, breech bearer, with leather cap	4	0
		1 shifting bar	11	0
		1 vent cover...	0	8

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
1st Line.	Gun, breech, mule—*continued.*	1 hammer	6	6
		1 sponge in two pieces, with metal connecting screws and plugs, and fitted for worm, Mark II. ...	10	4
		1 sponge cap, No. 2...	0	3
		1 block, dismounting	6	4
			239	1
		Total	327	13
	Axle mule.	SADDLERY.		
		1 set M.B. harness, ordnance (*vide* list)	19	9
		1 axletree cradle	47	9
		1 pair pannels	20	7
		1 axle strap	0	4
			87	13
		LOAD.		
		1 axle-tree, Mark II.	86	3
		1 half-round grease box, with strap	1	12
		1 trunnion guard	10	13
		1 worm, wadhook, with strap ...	0	15
		2 ammunition boxes, Clarkson's ...	18	0
		Containing—		
		Near Box. (Weight. lb. oz.)		
		1 axle bolt spare 1 9		
		2 case shot 14 0		
		4 cartridges in cover ... 6 1¾		
		1 cartouche 0 15		
		1 gas ring... ... ... 0 2		
		*2 lanyards 0 4		
		1 phosphor bronze scissors 0 3½		
		1 drag washer, M.S. ... 1 5		
		*1 leather funnel 0 3		
		*1 reciprocating bracket ... 4 3	28	14¼

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.			Weight. lb.	Weight. oz.
		Off Box.	lb.	oz.		
		2 case shot	14	0		
		1 claw hammer	0	14		
		1 McMahon spanner, 9-in.	1	8		
		1 oil can, tin, ½-pint ...	0	3		
		1 clip plate	4	1		
		1 gas ring...	0	2		
		*5 boxes friction tubes ...	2	15		
		1 small stores holdall ...	0	7		
		Containing—				
		*2 common spikes, iron ...	0	1½		
		*2 spring spikes	0	1½		
		1 gas ring, lever	0	2½		
		1 claspknife, with marline-spike	0	5½		
		*Raw silk	0	1		
1st Line.	Axle mule—*continued.*	4 phosphor bronze needles	0	0½		
		*1 tangent scale, special ...	1	3		
					26	1½
					172	10¼
		Total			260	7[illegible]
		In addition to above— 1 telescope, in No. 1 subdivision. 1 pair field binocular glasses, in No. 3 subdivision. 1 copper scraper in near box, in No. 2 subdivision. The axle mule of the spare carriage (4th Line) is equipped similarly to the above, with the exception of those articles marked *.				
		SADDLERY.				
		1 set M.B. harness, ordnance, except surcingle (*vide* list)			17	9
	Wheel mule.	1 wheel cradle			47	4
		1 pair pannels			20	7
		1 wheel strap, 82 in. × 1½ in. ...			1	2½
		1 elevating gear strap			0	8½
					86	15

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	oz.
1st Line.	Wheel mule—*continued.*	2 wheels	215	0
		1 set elevating gear, carriage ...	41	14
		*2 water buckets, G.S., canvas ...	1	4
			258	2
		Total	345	1
		The wheel mule of the spare carriage (4th Line) is equipped similarly to the above, with the exception of the stores marked *.		
	Carriage mule	SADDLERY.		
		1 set M.B. harness, ordnance (*vide* list)	19	9
		1 carriage cradle	42	9
		1 pair pannels	20	7
		2 carriage straps, 54 in. × 1½ in. ...	1	9
			84	2
		LOAD.		
		1 mountain carriage (without wheels, axletree, and elevating gear), *Mark II.*	196	0
		1 carriage lifter	7	0
		1 gun chase lifter	6	8
		1 check rope	5	0
		2 carriage spanners	2	8
			217	0
		Total	301	2
		The spare carriage mule (4th Line) is equipped similarly to the above.		

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

·	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
1st Line.	Ammunition mule.	SADDLERY.		
		1 set M.B. harness, ordnance, except surcingle (*vide* list)	17	9
		1 ammunition cradle	44	15
		1 pair pannels	20	7
		1 strap, lashing overall, 129 in. × 3 in.	3	1
			86	0
		LOAD.		
		2 ammunition boxes ... near	22	13
		2 ammunition boxes ... off	24	10
		Containing—		
		1 box sundries	2	2
		1 box fuzes for 6 R.L. percussion ...	3	5¼
		2 cartouches (8 cartridges in each)	3	6
		1 key, fuze, universal	0	5
		16 cartridges in paper covers ...	24	7
		2 case shot	14	0
		4 common shell	28	0
		10 shrapnel shell	70	0
		12 short time and percussion fuzes	10	13
		1 canvas cover, 6 ft. × 6 ft. ...	8	8
			212	5¼
		Total ...	298	5¼
		In addition to above, 1 hook removing G.S. wads is carried in No. 1 subdivision.		

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
3rd Line.	Ammunition mule.	SADDLERY AND LOAD.		
		As for 1st Line ammunition mule above	298	5¼
		1 strap, cloak, and line gear ...	0	6
		1 set line gear (*vide* list)	18	3
		1 great-coat	5	0
		Total ...	321	14¼
		N.B.—1st ammunition mule carries, in addition, 1 bambro' line and 1 lb. marline. 6th ammunition mule carries, in addition, 1 bull's-eye lantern; 4 portfires; 1 portfire clipper.		
		1 sponge cloth is carried in every near ammunition box.		
1st Line.	Pioneer mule.	SADDLERY.		
		1 set M.B. harness, ordnance, except surcingle (*vide* list) ...	17	9
		1 pack-saddle, G.S., complete with pannels	26	0
			43	9
		LOAD.		
		1 pair racks, leather, intrenching tools	22	0
		2 axes with helves	13	0
		1 miner's pinching bar, 3 ft. 6 in....	12	0
		2 sledge-hammers	16	0
		4 billhooks	8	10
		4 pickaxes, with helves	32	0
		4 implements, entrenching... ...	12	0
		8 fathoms cordage, 1 inch	2	0
		6 small reaping-hooks	12	15
		4 hand hatchets	8	0
		6 helves, spare, of sorts	11	0
			149	9
		Total ...	193	2

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd, or Relief Line.	Gun chase mule.	SADDLERY.		
		As for 1st Line mule	86	10
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			91	0
		LOAD.		
		2 sets line gear	36	6
		2 nose-bags	2	0
		2 canvas covers, 6 ft. × 6 ft. ...	17	0
		3 great-coats...	15	0
			70	6
		Total ...	161	6
	Gun breech mule.	SADDLERY.		
		As for 1st Line mule	88	8
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			92	14
		LOAD.		
		1 sponge	10	4
		1 sponge cap, No. 2...	0	3
		2 sets, line gear	36	6
		2 nose-bags	2	0
		1 pair light drag ropes	8	0
		2 canvas covers, 6 ft. × 6 ft. ...	17	0
		3 great-coats...	15	0
			88	13
		Total ...	181	13
		In addition to the above— 1 gun breech bearer, weight 4 lbs., in No. 1 subdivision. 1 shifting bar, weight 11 lbs., in No. 2 subdivision.		

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd, or Relief Line.	Axle mule.	SADDLERY.		
		As for 1st Line mule	87	13
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			92	3
		LOAD.		
		2 sets line gear	36	6
		2 nose-bags	2	0
		2 canvas covers	17	0
		3 great-coats...	15	0
			70	6
		Total ...	164	9
		The relief axle mule for spare carriage (4th Line) is equipped similarly to the above.		
	Wheel mule.	SADDLERY.		
		As for 1st Line mule	86	15
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			91	5
		LOAD.		
		1 box, ammunition	13	6
		Containing—		
		3 star shell	19	0½
		3 cartridges, 6 oz., in cover ...	1	3
		1 canvas cartouche, to hold 3 6-oz. cartridges	0	8
		* 1 box, fuzes, wood, M.L., 15-inch, special priming	0	15
		* 3 bits, hook-borer	0	1½
		* 1 cylinder, wood, common ...	0	3
		* 1 handle, hook-borer	0	2
		* 1 hook, hook-borer	0	6

* When Armstrong star shell are carried, 3 fuzes, time and concussion, small, with thin suspending wire, weight 2 lb. 8 oz., are substituted.

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	oz.
2nd, or Relief Line.	Wheel mule—*continued.*	2 sets line gear	36	6
		2 nose-bags	2	0
		2 canvas covers, 6 ft. × 6 ft. ...	17	0
		3 great-coats...	15	0
			106	3
		Total	197	8
		The relief wheel mule of the spare carriage (4th Line) is equipped similarly to the above, except that the star shell box contains only the cartouche.		
	Carriage mule.	SADDLERY.		
		As for 1st Line mule	84	2
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			88	8
		LOAD.		
		2 sets line gear	36	6
		2 nose-bags	2	0
		2 canvas covers, 6 ft. × 6 ft. ...	17	0
		3 great-coats...	15	0
			70	6
		Total	158	14
		In addition to the above, a piasaba brush, weight 6 lb., is carried in Nos. 1 and 4 subdivisions.		
		The relief spare carriage mule (4th Line) is equipped similarly to the above.		

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd, or Relief Line.	Ammunition mule.	SADDLERY.		
		As for 1st Line mule	86	0
		2 sets line gear straps	4	0
		1 cloak and line gear strap ...	0	6
			90	6
		LOAD.		
		2 sets line gear	36	6
		2 nose-bags	2	0
		2 tarpaulins, 10 ft. × 6 ft. (for ammunition)	40	0
		1 canvas cover, 6 ft. × 6 ft. ...	8	8
		3 great-coats	15	0
			101	14
		Total ...	192	4
		In addition to the above, the relief ammunition mules of Nos. 1, 3, and 5 subdivisions carry 1 set line gear and 1 canvas cover 6 ft. × 6 ft., belonging to the pioneer mules for their respective divisions.		
4th Line.	Forge mule.	SADDLERY.		
		1 set M.B. harness, ordnance, except surcingle (*vide* list)	17	9
		1 ammunition cradle	44	15
		1 pair pannels	20	7
		1 tool box strap	1	5
			84	4
		LOAD.		
		1 smith's anvil, portable forge ...	52	0
		1 anvil block, " " ...	37	0
		1 box for tools, " " ...	14	0
		1 pack-saddle, forge	106	0

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
4th Line.		1 hammer, handled, uphand, 7 lb.	7	0
		1 slice	0	14
		1 poker	0	10
		2 forge straps, 74 in. × 1½ in. ...	3	10
		1 „ „ 30 in. × ¾ in. ...	0	2½
		2 „ „ 26 in. × ¾ in. ...	0	4
	Forge mule—*continued.*	Total ...	234	8½
			318	12½
		The line gear, &c., of this mule is carried on a spare baggage mule.		
		Saddlery.		
		As for forge mule, except strap ...	82	15
		1 cloak and line gear strap ...	0	6
			83	5
		Load.		
		2 artificer boxes, Clarkson's ...	51	0
	No. 1 artificer mule.	Containing—		
		Tools, smiths'	74	0
		Tools, farrier and shoeing-smiths'...	46	0
		2 tool holdalls, artificers'	5	0
		2 sets extra tools for holdalls ...	30	0
		1 set line gear	18	3
		1 nose-bag	1	0
		1 canvas cover, 6 ft. × 6 ft. ...	8	8
		1 great-coat	5	0
			238	11
		Total ...	322	0

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
4th Line.	No. 2 artificer mule.	SADDLERY.		
		As for No. 1 artificer mule... ...	83	5
		LOAD.		
		2 artificer boxes, Clarkson's ... Containing—	51	0
		Tools, collar-makers'	20	0
		2 tool holdalls, artificers'	5	0
		2 sets extra tools for holdalls ...	24	0
		1 set line gear	18	3
		1 nose-bag	1	0
		1 canvas cover, 6 ft. × 6 ft. ...	8	8
		1 great-coat	5	0
			182	11
		Total ...	216	0
	No. 3 artificer mule.	SADDLERY.		
		As for No. 1 artificer mule... ...	83	5
		LOAD.		
		2 artificers' boxes, Clarkson's ... Containing—	51	0
		Tools, wheelers'	27	0
		2 tool holdalls, artificers'	5	0
		2 sets extra tools for holdalls ...	20	0
		1 set line gear	18	3
		1 nose-bag	1	0
		1 canvas cover	8	8
		1 great-coat	5	0
			135	11
		Total	219	0
5th Line.	Baggage mule.	SADDLERY.		
		1 set M.B. harness, baggage mule (*vide* list)	15	2
		1 pack-saddle, G.S., with 4 girth straps, and pannels	26	0
		1 cloak and line gear strap ...	0	6
			41	8

MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
5th Line.	Baggage mule —*continued.*	LOAD.		
		1 set line gear	18	3
		1 nose-bag	1	0
		8 canvas cover, 6 ft. × 6 ft. ...	8	8
		1 great coat	5	0
		1 forage cord	0	8
		Baggage or stores ... ... about	150	0
			183	3
		Total ...	224	11
		In addition to above, 36 small reaping-hooks, 48 pairs forage nets, 5 24-bushel corn sacks, are distributed among the baggage mules.		

Packing of Ammunition.

FOR A 6-GUN BATTERY, MULE EQUIPMENT.

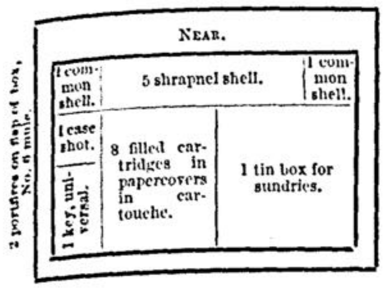
	Shrapnel shell.	Common shell.	Case shot.	Star shell.	Cartridges, 1 lb. 8 oz. in paper covers.	Cartridges, 6 oz. in paper covers.	Fuzes, time and percussion.	Fuzes, time and concussion, small, with thin suspending wire.	Fuzes, time, wood, 15 secs. with special priming.	R.L. fuzes.	Thimbles with detonators, small, with thin suspending wire.	Cartouches.	Port-fires.	Plugs.	Keys, special.	Boxes, tin, fuze, for R.L. fuzes.
Each ammunition mule	10	4	2	...	16	...	12	...	...	6	...	2	4 on each No. 6 ammunition mule.	14	1	1
„ axle mule ...	...	...	4	...	4	...	...	...	...	...	...	1		...	...	...
„ relief wheel mule	...	...	...	3	...	3	...	3*	3†	...	5*	1		...	...	...
Total per subdivision	60	24	16	3	100	3	72	3*	3†	36	5*	14		87	6	6
„ „ battery ...	360	144	100‡	18	604	18	432	18*	18†	216	30*	85§		522	36	36

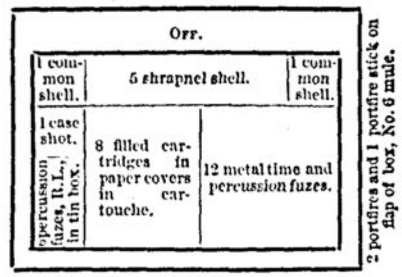
Reserve ammunition, 50 per cent. of above.

* When E.O.C. star shell are carried.
† When R.L. star shell are carried.
‡ Includes 4 rounds on spare axle mule.
§ Ammunition boxes, 72; case shot boxes, 7; star shell boxes, 6.

MULE EQUIPMENT—*continued.*

Detailed Arrangement of interior of each Box.





NOTES ON PACKING.

Canvas Covers.

All canvas covers for harness are carried folded over the tops of the cradles and under the loads.

2 canvas covers, 6 feet × 6 feet, Field Hospital, are issued to every officer's baggage and kit mule.

Kits.

Kits are carried rolled up in canvas covers, 3 in each.

Great-Coats.

Great-coats are carried on the tops of the cradles, folded the length of a sword blade and hilt, and doubled.

Knee-Caps.

Black leather knee-caps are carried by Nos. 1 to 7 of each subdivision.

Tents.

Extra mules are provided for the carriage of tents when issued.

Line Gear.

The line gear of the bare-backed mules is carried by the spare baggage mules except the blankets, web surcingles, and pads, which are carried by the bare-backed mules themselves.

MULE EQUIPMENT—*continued.*

NOTES ON PACKING—*continued.*

Mallets.

One "Mallet, wood, handled, heel peg," is carried on each officer's baggage and kit mule.

Harness Brushes and Hoof-Pickers.

These are issued at the rate of one per mounted man, driver, and muleteer, and are carried in the line gear bags, except the hoof-pickers of the mounted men, which are carried on the near shoe pocket strap.

Scissors.

6 pairs of trimming scissors per subdivision are carried in the line gear bags.

Shoes.

When shoes are required for the mules, a proportion will be carried in the line gear bags, each set, with its nails, being sewn up in canvas.

Camp-Kettles.

Camp-kettles are carried in nests of 5 in the racks in which they are issued. These racks are packed in sacks.

Linch Pins and Washers.

These are carried in pockets by Nos. 2 and 3 of detachments except for the spare carriage, where they are carried on the axletree arms. A spare linch pin and washer is carried in the near box on each axle mule.

Sights.

One fore-sight and one tangent scale are carried in pockets by No. 1. The second set is carried in pockets on the gun chase mule, and the special tangent scale and reciprocating bracket in the boxes on the axle mule.

Range-Finders, Watkin's.

Two sets are issued and are carried in Nos. 1 and 6 subdivisions, either by the range-takers or on spare baggage mules.

Artificers' Tools.

In addition to the usual sets issued to artificers, two small sets of indispensable tools are issued in order that each division may be complete when detached. These tools are carried in holdalls.

Lanterns.

Two brass globular lanterns are carried on the office mule.

Materials for Repair and Spare Articles of Equipment.

A small quantity of materials for repair is carried in the artificers' boxes; the remainder, together with spare articles of equipment, is carried on the store mules in valises of a special pattern issued for the purpose.

INDIAN MULE EQUIPMENT.

Number of pack saddles in a battery (with necessary harness) :—

Ordnance	117
Baggage	73

A set of mountain battery harness consists of 1 saddletree or cradle as under :—

	No. per battery.		
a. For chase	12		Of different construction according to the load to be carried.
b. " breech	12		
c. " carriage ...	14	including spare carriage	
d. " axle	14		
e. " wheels	14		
f. " ammunition ...	51		
g. " pioneer tools ...			
h. " artificers' boxes			
i. " forge			
Total ...	112		

Also :—

1 Breast piece.
1 Breeching.
1 Crupper.
2 Girths.
4 Girth straps.
1 Pair pads.
1 Metre crupper strap.
1 Surcingle ... ... } For gun mules only.
2 Metre surcingle straps }
One paulin is supplied for each set of harness.

TOTAL DISTRIBUTION OF MULES.

ORDNANCE MULES.		BAGGAGE MULES.	
1st line	36	Officers	4
2nd line (relief)	36	Kits (179 N.C.O.'s and men)	30
3rd line, Ammunition ...	30	Cooking utensils	6
Pioneer	3	Water mules...	6
4th line: Artificers	3	Stores and half wrought ...	8
4th line: Spare carriage ...	6	Office	1
4th line: Bare-backed ...	24	Veterinary boxes	1
		Charcoal	1
		Spare (2 saddled and 2 bare-backed) per subdivision ...	24
Total	138	Total	81

INDIAN MULE EQUIPMENT—*continued.*

DETAIL OF PACKING.

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
1st Line.	Gun chase mule.	1 set of M.B. harness for gun chase	40	0
		1 gun chase cradle	35	4
		1 muzzle portion	199	0
		1 gun chase bearer	8	8
		2 straps, gun muzzle or chase lash-	0	8
		ing	0	4
		1 gun bucket, strapped on near side	2	12
			286	4
	Gun breech mule.	1 set of M.B. harness for gun breech	40	0
		1 gun breech cradle	33	0
		1 breech portion	201	0
		1 bearer, gun breech	4	0
		1 leather vent-cover (on gun) ...	0	2
		1 gun hammer (strapped on near side of saddle)	7	0
		1 dismounting block or grummet (strapped on near side of saddle, rear strap passed over head of hammer)	2	0
		2 straps, gun, breech, lashing ...	0	8
		2 straps, lashing, hammer	0	4
		2 straps, lashing, shifting bar ...	0	4
		1 shifting bar (strapped on off side of saddle)	13	0
			301	2
	Axle mule.	1 set of M.B. harness for axle ...	39	0
		1 axle cradle	42	0
		1 axle-tree	79	0
		1 trunnion guard (carried in a leather pocket on off side of saddle)	10	8
		2 boxes, small stores (filled) ...	96	0
		1 muzzle tampeon (in store box when not in muzzle)	2	0
		2 straps, lashing, axle	0	8
		1 pocket for trunnion guard ...	1	0
			270	0

INDIAN MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight.	
			lb.	oz.
1st Line.	Wheel mule.	1 set of M.B. harness for wheels ...	40	0
		1 wheel cradle	39	12
		2 wheels	215	0
		1 elevating gear on saddle between wheels	36	0
		1 strap, lashing, wheel	0	8
		1 bag, water (filled)	7	0
			338	4
	Carriage mule.	1 set of M.B. harness for carriage...	40	0
		1 carriage cradle	35	0
		1 carriage	206	0
		2 straps, lashing, carriage	1	0
		1 strap, lashing, handspike ...	0	2
		2 straps, lashing, sponge and rammer	0	4
		1 tin, grease, with strap (strapped on left bracket of carriage) ...	0	12
		1 pair of drag ropes	4	0
		1 check rope...	2	0
		1 handspike, traversing	4	0
		1 sponge on left bracket of carriage	4	0
		1 rammer (strapped on right bracket of carriage and hooked to trail)	5	4
			302	6
	1st ammunition mule.	1 set of M.B. harness for ammunition mule...	39	0
		1 ammunition cradle	28	0
		2 straps, lashing, ammunition boxes	0	8
		1 pair ammunition boxes	228	0
		1 ammunition box paulin	8	8
		1 paulin, harness	8	8
		1 set of line gear (nose bag separate)	33	9
		1 nose-bag (on near side of saddle)	1	0
		1 great-coat (driver's)	5	0
			352	1

INDIAN MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd Line, or relief for 1st Line.	Relief gun chase mule.	1 set of M.B. harness for gun chase	40	0
		1 gun chase cradle	35	4
		2 straps, lashing, gun chase ...	0	8
		2 straps, lashing, bearer	0	4
		2 sets of line gear	67	2
		2 nose bags (one on either side of saddle)	2	0
		2 paulins, harness	17	0
		A proportion of great-coats (gunners')	24	0
			186	2
	Relief gun breech mule.	1 set of M.B. harness for gun-breech	40	0
		1 gun-breech cradle	33	0
		2 straps, lashing, gun-breech ...	0	8
		2 straps, lashing, hammer	0	4
		2 straps, lashing, shifting bar ...	0	4
		2 sets of line gear	67	2
		2 nose-bags (one on either side of saddle)	2	0
		2 paulins, harness	17	0
		A proportion of great-coats (gunners')	24	0
			184	2
	Relief axle mule.	1 set of M.B. harness for axle ...	39	0
		1 axle cradle...	42	0
		1 strap, lashing, axle	0	4
		2 sets of line gear	67	2
		2 nose-bags (one on either side of saddle)	2	0
		2 paulins, harness	17	0
		A proportion of great-coats ...	24	0
			191	6

INDIAN MULE EQUIPMENT—*continued.*

DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd Line, or relief for 1st Line.	Relief wheel mule.	1 set of M.B. harness for wheels ...	40	0
		1 wheel cradle	39	12
		1 strap, lashing, wheels	0	8
		1 implement box (on top of saddle)	11	8
		1 holdall (on top of implement box)	5	4
		2 sets of line gear	67	2
		2 nose-bags (one on either side of saddle)	2	0
		2 paulins, harness	17	0
		A proportion of great-coats (drivers')	20	0
			203	2
	Relief carriage mule.	1 set of M.B. harness for carriage	40	0
		1 carriage cradle	35	0
		2 straps, lashing, carriage	1	0
		2 sets of line gear	67	2
		2 nose-bags (one on either side of saddle)	2	0
		2 paulins, harness	17	0
		1 sponge and cap, spare (on off side of saddle)	5	4
		A proportion of great-coats ...	20	0
			191	8
	Relief ammunition mule.	1 set of M.B. harness for ammunition mule...	39	0
		1 ammunition cradle	28	0
		2 straps, lashing, ammunition boxes	0	8
		2 sets line gear (its own and one of the ponies)	67	2
		2 nose-bags	2	0
		2 paulins, harness	17	0
		1 great-coat (driver's)	5	0
			158	10

INDIAN MULE EQUIPMENT—*continued.*

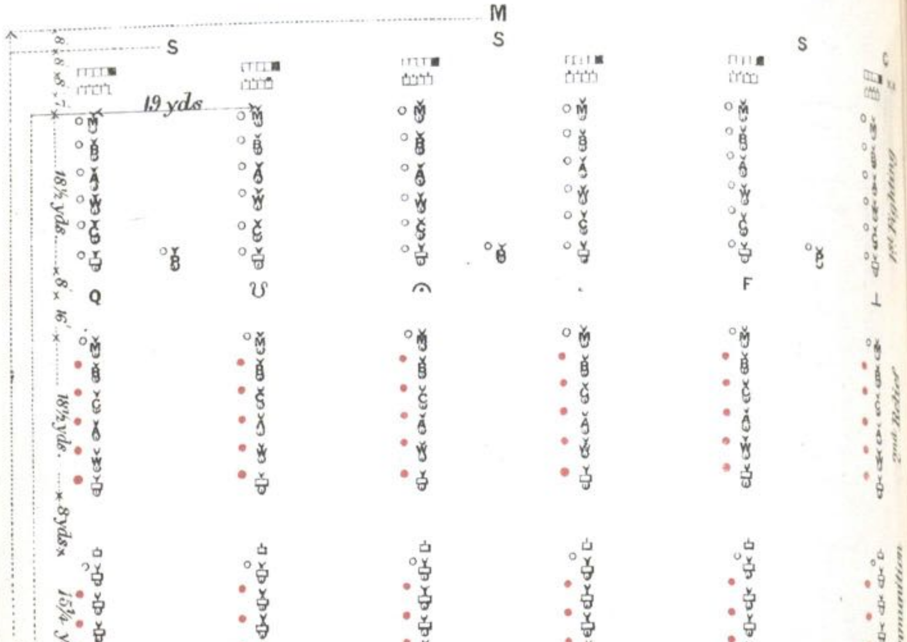
DETAIL OF PACKING—*continued.*

	Description of Mule.	Articles carried.	Weight. lb.	Weight. oz.
2nd Line, or relief for 1st Line.	Artificer mule.	1 set of M.B. harness for ammunition saddle	39	0
		1 ammunition cradle	21	0
		2 boxes artificer's tools, &c. ...	206	0
		1 set line gear	33	9
		1 nose-bag	1	0
		1 paulin, harness	8	8
		1 great coat (driver's)	5	0
			321	1
	Pioneer mule.	2 (pioneer tools) leather racks ...	16	0
		4 mamooties	28	0
		2 axes	13	8
		1 crowbar, iron	16	0
		2 spades	11	0
		2 billhooks	4	0
		4 pickaxes	32	0
		5 spare helves	9	0
		8 fathoms cordage, 2 log-lines ...	9	0
		16 banderoles, 4 mallets	22	4
		1 paulin, harness	8	8
		1 set M.B. harness	39	0
		1 ammunition cradle	28	0
		1 great coat (drivers)	5	0
		1 set line gear	33	9
			274	13

Mule Equipment.

MOUNTAIN BATTERY DRAWN UP FOR INSPECTION.

2·5 inch Gun



Spare Gunners, Drivers Etc. in two ranks 5 yards in rear of Centre.

M *Major*	*Collar Mr*	*Gun Chase*	*Forge*	*Gunner*
C *Captain*	F *Farrier*	*Breech*	*Artificers Tools*	*Driver*
S *Subaltern*	X *Trumpeter*	*Carriage*	*Ammunition*	*Muleteer*
⊥ *Sgt Major*	*S. Smith*	*Axletree*	*Baggage*	*No 1*
Q *Qr Mr Sgt*	*Pioneer Tools*	*Wheels*	*Spare Horse*	*Coverer*
				Spare Mule

MULE EQUIPMENT.

FORMATION OF THE BATTERY, &c.

On "Boot and saddle" being sounded, the gunners, except limber gunners, assist the drivers to saddle and get ready the mules; and when "Fall in" is sounded, the battery falls in by subdivisions, and each subdivision is inspected by its No. 1. The drivers then proceed to the stables or lines in charge of the Nos. 1, load up the line gear loads, and get ready to file out. The gunners are marched to the gun-park by the quartermaster-sergeant, the guns are run out, the ammunition boxes placed on the ground in pairs ready for loading, commencing 5 yards in rear of the guns, and the remaining loads arranged by pairs in the most convenient position. When "Turn out" is sounded, the mules are marched to the parade ground by the officer on duty, or in his absence, the sergeant-major, the ammunition and pioneer loads are put on by the detachments, under the superintendence of the Nos. 1, and the baggage loads by the spare numbers, under the superintendence of the quartermaster-sergeant. As soon as the ammunition loads are on, the detachments fall in on their guns; the sergeant-major then gives the word "Front limber up," the guns are limbered up in the usual manner, and all the mules proceed to their places in line, the detachments falling in in front by word of command from the Nos. 1. The subaltern officers then inspect their divisions on foot, and the battery is told off and proved by the captain or officer on duty, as laid down for a Field Battery.

The first line consists of the five gun and carriage mules, and the first ammunition mule, the second line of the five relief gun and carriage mules and the relief ammunition mule, the third line of the remaining ammunition mules, the fourth line of spare carriage, bare-backed ordnance, and artificer mules, and the 5th line of the water and baggage mules, the water mules of each subdivision leading; the pioneer mules fall in in the centre of their divisions in line with the first ammunition mules. The officers fall in as laid down for a Field Battery.

Distances and Intervals.

In line a distance of ½ yard is maintained from nose to croup of the mules of each line, and a distance of 8 yards between lines. In column of route the distance between lines is reduced to 1½ yards; but it is advisable, in order to reduce the length of the column, to march, where practicable, in column of divisions; this can be done on any road of ordinary width. Detachments before moving off in column of route form the "Order of march," and the spare numbers are distributed at intervals amongst the baggage mules in order to assist in adjusting any loads that get out of place, and in tightening or letting out the breechings, when required.

The intervals between subdivisions in line are—

Full	...	...	19 yards.
Half	...	...	9½ ,,
Close	...	...	4 ,,

MULE EQUIPMENT—*continued.*

Movements in the Field.

The normal pace of manœuvre for Mountain Batteries is the "walk," but, if necessary, on an emergency, the pace can be increased to a "trot." As a rule, the 1st line only will manœuvre. Drill movements for a Mountain Battery correspond to those laid down for a Field Battery. In "reversing" or "taking ground," detachments, when at the "order of march," wheel round with the mules, each number remaining on his proper side; when at "detachments front," they wheel "right," "left," or "about" on their own ground; mules "reverse" or "take ground" on their own ground.

GUN DRILL.

The detachment consists of nine numbers, and falls in two deep, two yards in rear of the gun which is unlimbered.

To tell off.

Officer.	No. 1.
Tell off.	

At "Tell off," No. 1 (who is on the right of his detachment) takes a pace to his front, turns to his left, and numbers himself 1, the right hand man of the rear rank numbers 2, the right hand man of the front rank 3; the second man from the right of the rear rank 4; the man in his front 5; and so on. After the detachment is told off, No. 1 falls in again on the right of the front rank.

This is the position of "Detachment rear."

The front is that direction in which the gun is pointed when in action, or to which the mules' heads are turned when limbered up.

Position of Detachment at the gun when in action.

No. 1, at the point of the trail.
Nos. 2 and 3, in line with the muzzle outside the wheels, and one pace from them.
Nos. 4 and 5, in line with the breech, covering Nos. 2 and 3.
No. 6, one yard in rear of No. 1, and covering him.
No. 7, 5 yards in rear of left gun wheel, and covering it.
Nos. 8 and 9 with the 1st ammunition mule.

To take post on the gun from Detachment Rear.

Officer.	No. 1.
Take post.	Right turn. Double March.

The numbers double to their places in action and halt, facing to the front.

MULE EQUIPMENT—*continued.*

No. 1 attaches the sight pockets to his belt.
No. 5 " the tube pocket "
Nos. 2 and 3 attach the linch pin and washer pockets to their belts.
All pockets are carried on the belts on the right side.
If the sponge and rammer are not strapped to the trail, No. 4 places them on the ground outside Nos. 2 and 3.
Nos. 1 to 7 strap on knee caps.

General duties in action.

No. 1 commands, fixes sights, superintends setting of fuzes, lays, and lifts at the handspike in running up or back.
No. 2 sponges, rams home, mans right wheel, and tightens check rope.
No. 3 loads, removes safety-pin from fuze, when in the bore, mans left wheel, and tightens check rope.
No. 4 attends to vent, pricks cartridge, mans right wheel, and fixes check rope.*
No. 5 fires, mans left wheel, and fixes check rope.*
No. 6 ships and unships handspike, lifts at the handspike in running up or back, and traverses.
No. 7 supplies No. 3 with ammunition from No. 8.
No. 8 sets and fixes fuzes (except when shells are fuzed at the gun), serves out ammunition to No. 7.
No. 9 assists No. 8 in serving out ammunition; brings up ammunition mules, as required.

Action.

Officer.	No. 1.
Action.	Action.

No. 1 takes out tangent and trunnion sights from pocket, screws trunnion sight into sight ring, satisfies himself that the gun is properly screwed home, and that the fittings are in good order, sees that the elevating gear is run up, and kneels on the right knee on the left of the handspike.

No. 2 takes up rammer,* turns to his left, kneels on his left knee, unscrews the coupling hook of rammer, screws rammer to sponge, seizes it in the right hand by the centre, rammer head to the rear, and tightens check rope with his left hand.

No. 3 takes up sponge,* turns to his right, kneels on his right knee, unscrews coupling hook of sponge, screws sponge to rammer, tightens check rope with his right hand.

No. 4 turns to his left,* kneels on his right knee, fixes check rope in front of the lowest spoke of the right wheel.

No. 5 turns to his right,* kneels on his left knee, fixes check rope in front of the lowest spoke of the left wheel, takes lanyard from tube pocket and puts it under his belt.

* When the rammer and sponge are carried on the trail, Nos. 4 and 5 supply them to Nos. 2 and 3.

MULE EQUIPMENT—*continued.*

No. 6 ships handspike, and kneels on his left knee, ready to traverse.

No. 7 kneels on his left knee.

Nos. 8 and 9 open the near ammunition box, and prepare to issue ammunition.

Load.

Officer.	No. 1.
Range—yards, or—degrees, elevation, with— Load.	With— Load.

No. 1 repeats the word of command, as to the nature of projectile, sets his tangent scale, clamps it, places it in the socket, examines the shell, when fuzed with time fuze, fixes and sets fuze, when shell are fuzed at the gun, hands it to No. 3, and lays.

No. 2 brings the sponge to a horizontal position in front of the bore, inserts sponge head (right hand back up, in centre of stave, left hand back down, close to sponge head), shifts the left hand to the right, forces the sponge up the bore until the left hand meets the face of the piece, shifts both hands to the rammer head, and forces the sponge hard home. He then gives the sponge two half turns, by first lowering and then raising his wrists, at the same time pressing the sponge hard against the bottom of the bore. The sponge is then withdrawn in two motions and reversed, the right hand holding the sponge by the centre, and the left hand meeting the rammer head opposite the bore.

When No. 3 has placed the charge in the bore, and removed the safety-pin, No. 2 introduces the rammer head into the bore, reaches out to the full extent of his arms, and rams home in one motion, with a firm pressure, left hand back up, right hand back down. He then quits the rammer, and remains steady until No. 4 has pricked the cartridge. The rammer is then withdrawn in one motion, and brought to its position in "action."

No. 3 slews his body to the right, and receives the ammunition from No. 7 (cartridge in the right hand, projectile in the left, backs of both hands down). He inserts them in the bore, as soon as the sponge is withdrawn, the choked end of the cartridge next to the base of the projectile, and withdraws the safety-pin from the fuze.

No. 4 serves the vent with his left thumb, keeping his elbow raised and his fingers on the left side of the gun. When the charge is home he pricks the cartridge, and then serves the vent whilst the rammer is being withdrawn.

No. 5 takes the lanyard from his belt, hooks a friction tube to it, and holds the lanyard in his left, and the friction tube in his right hand.

No. 6 traverses under the directions of No. 1.

No. 7 receives a round of ammunition from No. 8 (taking the projectile in his right hand, and the cartridge in his left, both hands

MULE EQUIPMENT—*continued.*

back up, choke end of the cartridge next to the base of the projectile) and hands it to No. 3.

The cartridge while being carried up to the gun should be covered by the right arm. If time fuzes are being used, the shell is handed to No. 1 for inspection.

No. 8 prepares projectiles and supplies No. 7 with ammunition.

No. 9 assists No. 8.

To Lay the Gun.

No. 1 places the elevating gear in the step suited for giving the required elevation; then looking over the sights, with his right hand on the elevating wheel and his left hand on the cascable, elevates or depresses, as may be necessary, at the same time giving the word "Trail right" or "Trail left" to No. 6. The gun must be laid with a full sight, *i.e.*, the object, the apex of the foresight, and the top of notch of the tangent scale must be brought into a straight line; the eye being kept about 6 inches from the tangent scale. If the cross wires are used, the eye must be brought close to the hole in the tangent scale. When the gun is correctly laid, No. 1 gives the word "Take post." No. 6 traverses as directed.

N.B.—To ascertain the deflection required, when one wheel is higher than the other, find out how many six-tenths of an inch there are in the difference of level of the wheels; multiply the number so found by the number of degrees of elevation given; the result will be the number of minutes deflection to be given to the higher wheel. In order readily to apply this rule, the pricker of each gun should be marked in divisions of six-tenths of an inch. The difference in level can be obtained by means of the sponge stave held across the wheels and measured with the pricker.

To Make Ready and Fire.

Officer.	No. 1.
Fire —— rounds or Commence firing.	Ready. Fire. Run up (or back). Halt.

As soon as No. 1 gives the word "Ready," he removes the tangent scale, keeping it clamped; he then moves to the side from which he can best observe the effect of his shot; the remaining numbers at the gun move clear of the recoil.

No. 5 presses a tube into the vent with his right thumb, extends the lanyard with his left hand, keeping his hand level with the vent, and looks towards No. 1.

At the word "Fire," No. 5, holding the lanyard taut with his left hand, chops it smartly with his right and replaces it under his belt. In the event of a miss-fire, No. 5 will place another tube in the vent from over the wheel and resume his position for firing.

No. 4, after the gun has been fired, clears the vent.

At the word "Run up," Nos. 4 and 5 loosen the check rope, if

necessary, Nos. 1 and 6 lift at the handspike, Nos. 2, 3, 4, and 5 man the wheels.

At the word "Halt," Nos. 4 and 5 refix the check-ropes, Nos. 2 and 3 tighten them, and the numbers resume their positions in "action."

N.B.—If it is necessary to control the recoil, drag-ropes are hooked to the washers and manned by all available numbers.

To cease firing.

Officer.	No. 1.
Cease firing.	Cease firing.

All the numbers stand up.

No. 1 unscrews the fore sight, and replaces both sights in the pocket.

Nos. 2 and 3 unscrew the sponge from the rammer, screw on the coupling hooks and place them on the ground clear of the wheels.*

Nos. 4 and 5 unfix the check rope, and hook it to the capsquare rings; No. 5 replaces the lanyard in the tube pocket.

No. 6 unships the handspike, and places it on the ground clear of the right wheel.

Nos. 8 and 9 adjust ammunition and close the boxes.

To change rounds in action.

Officer.	No. 1.
Change rounds.	Change rounds.

In changing rounds	No.	2	becomes	4
	"	4	"	1
	"	1	"	6
	"	6	"	8
	"	8	"	9
	"	9	"	7
	"	7	"	5
	"	5	"	3
	"	3	"	2

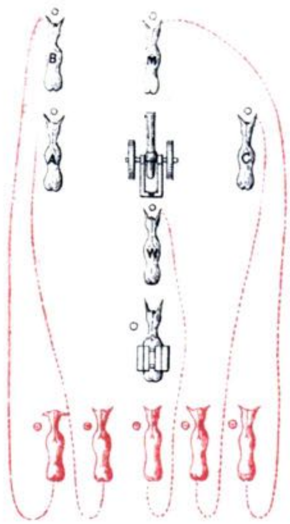
When in action to form "detachment rear."

Officer.	No. 1.
Detachment rear.	Detachment rear. Double march. Halt. Front.

No 1 places himself two yards in rear of the gun, opposite the right wheel, and facing to the left; all the numbers double up and

* When the rammer and sponge are carried on the trail, Nos. 2 and 3 throw them to Nos. 4 and 5, who replace them.

To face page



FIGS 2 and 3

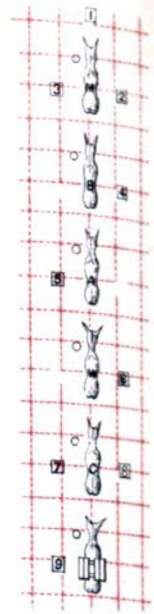
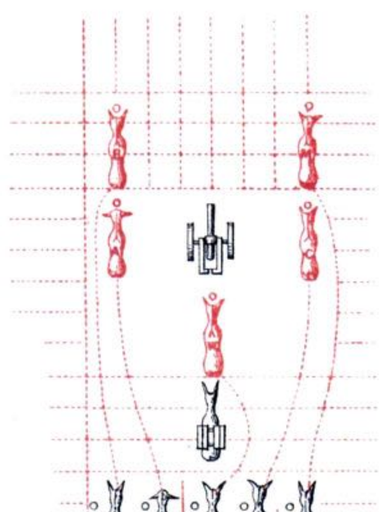


FIG 1



FIGS 4 and 5

FIG 1 *Order of March*
FIG 2 *Halt Action Front*
FIG 3 *In Action*
FIG 4 *do do.*
FIG 5 *Front Limber up*

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MULE EQUIPMENT—*continued.*

form facing No. 1, Nos. 2 and 3 marking time opposite No. 1, until the word "Halt" is given. At the word "Front," all the numbers turn to the front.

To limber up (see Figs. 4 and 5).

Officer.	No. 1.
Front limber up.	Front limber up. Lift.

Limbering up is, as a rule, done only to the front. At "Limber up" the mules are brought up at a trot from the rear, and halted as follows:—

Carriage mule 3 yards on the right of the axle.
Axle mule 3 yards on the left of the axle.
Chase mule 3 yards in front of the carriage mule.
Breech mule 3 yards in front of the axle mule.
Wheel mule 3 yards in rear of the trail.
The gun is limbered up by a series of 3 separate lifts.

1st Lift.

The dismounting block having been placed by No. 1, one yard in front of the muzzle, the capsquares are removed by Nos. 2 and 3, who bear down on the muzzle, the elevating gear is removed by No. 6, and strapped on the wheel cradle; the shifting bar is passed through the cascable by No. 4. No. 1 gives the word "*Lift*," Nos. 2 and 3 *lift* at the muzzle, Nos. 4 and 5 at the breech; the gun is lifted out of the trunnion holes, and placed vertically in the dismounting block. No. 2 unscrews the junction nut, No. 3 using the hammer to start it, if necessary, the trunnion block having been placed on the trunnion by No. 2. No. 4 steadies the muzzle portion, No. 5 the breech.

N.B.—In soft ground the dismounting block is placed on the trail plate.

2nd Lift.

No. 3 brings up and adjusts the chase bearer.*

Nos. 2, 3, and 4 lift the chase off the breech and place it on the chase mule; No. 2 replaces the bearer.

No. 1 places the breech bearer in the bore, gives the word "lift," and the breech is then lifted by Nos. 1, 5, and 6, and placed on the breech mule, No. 6 withdrawing and replacing the shifting bar.

3rd Lift.

The capsquares having been replaced, and the axle-clips removed by Nos. 8 and 9, No. 7 gives the word "Lift;" Nos. 7, 8, and 9 lift the carriage; No. 8 passes the carriage bearer under the breast to No. 9, No. 7 lifts at the point of the trail, and the carriage is placed on the carriage mule. No. 8 withdraws and replaces the carriage bearer. Nos. 2 and 3 then remove the linch-pins and washers, Nos. 2 and 8 lift the right, Nos. 3 and 9 the left wheel off the axle and place them on the wheel mule. Nos. 6 and 7 place the axle, and No. 5 the trunnion

* If a chase fid is used, it is placed in the bore by No. 1.

MULE EQUIPMENT—*continued.*

block on the axle mule. No. 4 places the dismounting block on the breech mule.

The mules form on the 1st ammunition mule in order of march. The detachment forms the order of march.

General Duties in Limbering up.

No. 1 commands, places dismounting block, places and lifts at bearer in placing breech on mule.

No. 2 removes right capsquare, bears down on muzzle, lifts gun to dismounting block, supplies himself with trunnion block, places it on left trunnion, if hammer is used, unscrews junction nut, lifts at right of chase bearer, buckles chase strap, and replaces bearer, removes right linch pin and washer, and lifts in front of right wheel.

No. 3 removes left capsquare, bears down on muzzle, lifts gun to dismounting block, supplies himself with hammer, and hammers left trunnions, if necessary, adjusts chase bearer, and lifts at left of it, buckles chase strap, removes left linch pin and washer, and lifts in front of left wheel.

No. 4 passes shifting bar through cascable, lifts gun to dismounting block, steadies muzzle, lifts chase at muzzle, straps on sponge and rammer, and replaces hammer.

No. 5 lifts gun to dismounting block, steadies breech, lifts at left of shifting bar, buckles breech strap, replaces trunnion block and dismounting block.

No. 6 removes and straps on elevating gear, lifts at right of shifting bar, buckles breech strap, withdraws and replaces shifting bar, lifts and straps on axle, and straps on handspike.

No. 7 lifts at point of trail, lifts and straps on axle.

No. 8 throws off right clip, passes bearer under carriage to No. 9 and lifts at right of it, buckles rear carriage strap, lifts in rear of right wheel and replaces carriage bearer.

No. 9 throws off left clip, lifts at left of carriage bearer, buckles front carriage strap, lifts in rear of left wheel and buckles wheel strap.

In loading, the chase is reversed to the left, the breech to the right, the numbers facing to the rear.

Position of detachment when in order of march:—

No. 1. One yard in front of chase mule.
No. 2. One yard on right of chase mule.
No. 3. One yard on left of chase mule.
No. 4. One yard on right of breech mule.
No. 5. One yard on left of axle mule.
No. 6. One yard on right of wheel mule.
No. 7. One yard on left of carriage mule.
No. 8. One yard on right of carriage mule.
No. 9. One yard on left of 1st ammunition mule.

In Changing Rounds when in Order of March.

No. 9	becomes	No.	7
No. 7	„	„	5
No. 5	„	„	3
No. 3	„	„	1
No. 1	„	„	2
No. 2	„	„	4
No. 4	„	„	6
No. 6	„	„	8
No. 8	„	„	9

MULE EQUIPMENT—*continued.*

From the order of March, to form Detachment front.

Officer.	No. 1.
Detachment front.	Double March. Halt, front.

No. 1 doubles obliquely to his right, to a point 5 yards in front of the chase mule, and 2 yards to the right. He turns to his left and gives the word "*Double march*"; the remaining numbers double up, Nos. 2 and 3 closing to 3 paces and wheeling to right opposite No. 1, the odd numbers covering No. 3, and the even numbers No. 2; when all have closed up, No. 1 gives the word "Halt," "Front," and the detachment halts, turns to the front and dresses by the right.

From Detachment Front, to form the Order of March.

Officer.	No. 1.
Form the Order of March.	Left turn. Double March.

The detachment turns to the left, wheels to the left, and the numbers double to their places in the order of march, halt, and turn about with the highest number.

From the Order of March, to come into Action (Figs. 2 and 3).

Officer.	No. 1.
"Action Front."	"Action Front." "Lift."

Coming into action is, as a rule, done only to the front.

On the command "Action Front," the chase mule remains stationary, the breech mule is brought up 3 yards to the left of the chase mule, the carriage mule 3 yards to the right of the position from which the breech mule moved, the axle mule to a similar position on the left, the wheel mule to one yard in rear of the same position, the 1st ammunition mule to one yard in rear of the wheel mule. All the mules are brought up at a trot. The bearers and shifting bar are placed on the ground clear of the wheels on their own sides, as soon as removed, after mounting the gun.

Coming into action is the converse of limbering up, and is performed by a series of three lifts.

As soon as the loads are lifted off the mules, the drivers lead their mules forward until clear of the load, then reverse outwards, and move to their position in "Action."

1st *Lift.*

At the word "Lift," Nos. 6 and 7 take off the axle and hold it on the left of the carriage mule, Nos. 2 and 8 take off the right, and Nos. 3 and 9 the left wheel, and place them on the axle; Nos. 7, 8, and 9 lift the carriage and place it on the axle, No. 7 lifting at the point of the trail, and No. 8 unshipping and passing the bearer to No. 9. Nos. 8 and 9 fasten the clips; Nos. 2 and 3 put on linch pins

MULE EQUIPMENT—*continued.*

and washers; No. 6 takes off, and ships elevating gear, No. 4 brings up the dismounting block, and No. 5 the trunnion block.

2nd Lift.

No. 5 unships and places the shifting bar; No. 1 gives the word "Lift," Nos. 1, 5, and 6 lift the breech and place it vertically in the dismounting block; No. 1 removes bearer from bore, and wipes screw with oil rag; No. 3 unships and places chase bearer; Nos. 2, 3, and 4 lift the chase and place it on the breech, the feather being fitted into the recess, and the faces of the two parts brought evenly together; No. 3 removes the chase bearer;* No. 2 screws up the junction nut, using the hammer if necessary, in which case No. 3 places the trunnion block, No. 4 steadies the muzzle portion, No. 5 the breech. When the lines on the breech and nut correspond, No. 1 gives the word "Home."

3rd Lift.

At the word "Lift," from No. 1, Nos. 4 and 5 lift at the breech, Nos. 2 and 3 at the muzzle. The gun is lifted into the trunnion holes, Nos. 2 and 3 fix cap squares, No. 4 withdraws the shifting bar from the cascable, and all the numbers take their places for "Action."

General Duties in coming into Action.

No. 1 commands, lifts at breech bearer, removes it from bore, and wipes screw.

No. 2 casts off rear chase strap, lifts in front of right wheel, and puts on right linch pin and washer; lifts at right of chase bearer, screws up junction nut, strikes trunnion block with hammer if necessary, lifts gun into trunnion holes, and places right capsquare.

No. 3 casts off front chase strap, lifts in front of left wheel, and puts on left linch pin and washer, places and lifts at left of chase bearer, removes it, places and holds trunnion block, if required, with his left hand, lifts gun into trunnion holes, and places left capsquare.

No. 4 brings up dismounting block, lifts at muzzle, and steadies chase while being screwed up, lifts gun into trunnion holes, removes shifting bar, unbuckles sponge and rammer (and places them outside wheels).†

No. 5 brings up trunnion block, places shifting bar, casts off front breech strap, lifts at left of shifting bar, and lifts gun into trunnion holes.

No. 6 takes off and places axle, casts off rear breech strap, lifts at right of shifting bar, takes off and ships elevating gear, ships the handspike.

No. 7 takes off and places axle, lifts at point of trail.

No. 8 lifts in rear of right wheel, casts off rear carriage strap, passes bearer under carriage to No. 9, and lifts at right of it; removes it, fixes right clip, and removes right capsquare.

No. 9 casts off wheel strap and lifts in rear of left wheel, casts off front carriage strap, lifts at left of carriage bearer, fixes left clip, and removes left capsquare.

In drilling with reduced numbers, the wheels are lifted by Nos. 2 and 3, without assistance, Nos. 5 and 6 performing the duties of 8 and 9.

* If a chase fid is used, it is withdrawn by No. 1.

† Not required when the sponge and rammer are attached to the carriage.

CAMEL EQUIPMENT.

DETAIL OF A SET OF PACK CAMEL HARNESS FOR CARRIAGE OF 2·5-INCH R.M.L. BATTERIES.

Description of Articles.			Number	Remarks.
Cradles			1	According to load, for carriage, forge with bellows, gun, or wheels.
Cruppers			1	
Girths, leather plaited	Cradles	front ...	1	
		rear ...	1	
	pads ...	front ...	1	
		rear ...	1	
Pads ... ... pairs			1	According to load, for ammunition boxes, cradles, intrenching tool pads or stores.
Straps, leather, lashing, 7-pr., R.M.L.			—	For ammunition boxes and carriages, side arms, handspikes, and bearers.
Straps, leather, lashing			—	For wheels, gun (breech and muzzle), or carriage.
Straps, leather, girth, connecting			1	
Strap, metre, crupper			1	
Tabs, girth	long		2	For front girths.
	short		2	For rear girths.
Throat bands			1	

The head gear is provided with the camel.

TABLES OF APPROXIMATE WEIGHTS OF THE SEVERAL LOADS IN A CAMEL BATTERY.

GUN BREECH CAMEL.	Weight. lb.	oz.	Weight. lb.	oz.
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
Dismounting block	6	4		
1 breech portion	200	8		
1 breech bearer	4	0		
1 shifting bar	11	0		
1 vent cover	0	8		
1 hammer	7	12		
1 sponge, 2·5-inch, Mark II., with cap ...	10	7		
			240	7
Forage (if carried)	...		33	0
Total	...		409	7

CAMEL EQUIPMENT—*continued.*

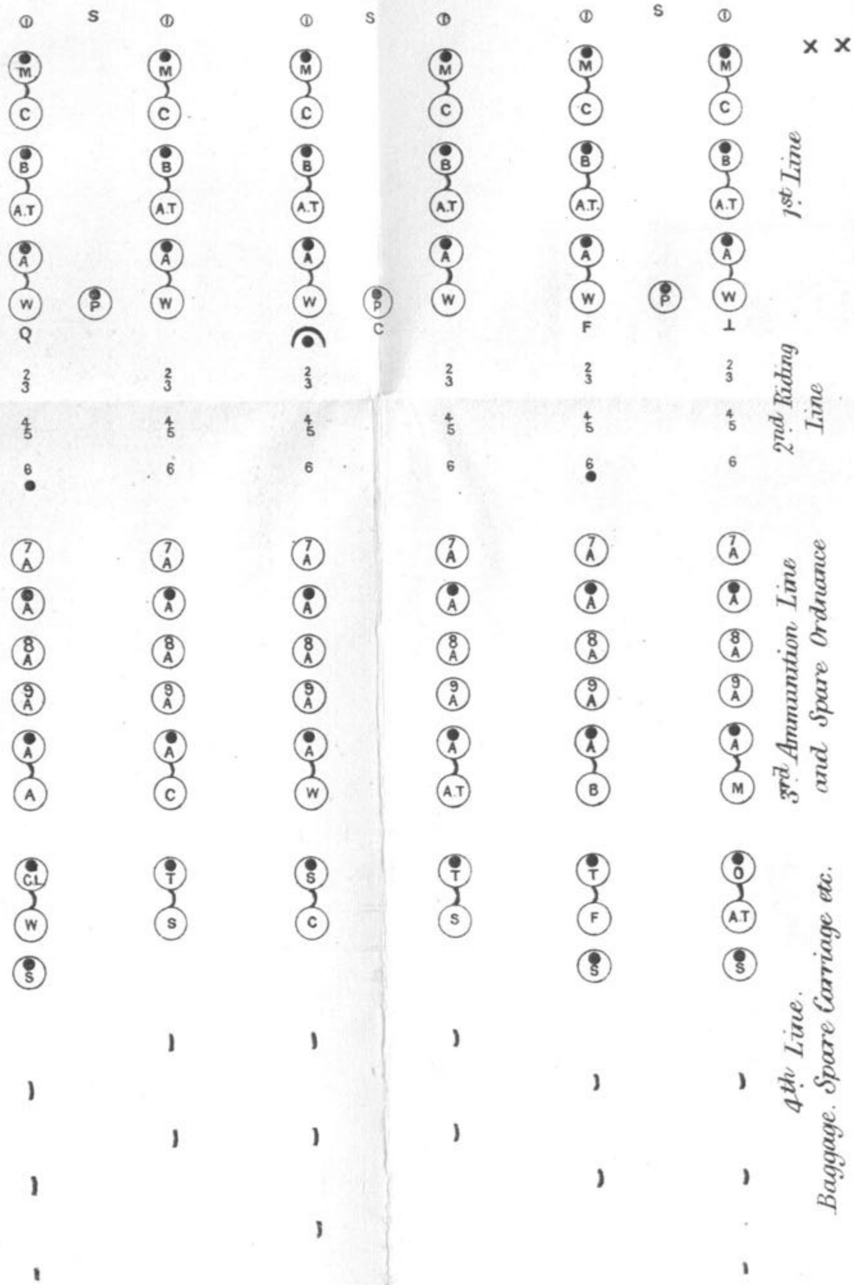
	Weight. lb.	oz.	Weight. lb.	oz.
Gun Chase Camel.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
1 chase portion	204	0		
1 sight cover	0	11		
1 chase cap	1	9		
2 handspikes	8	0		
1 pocket clinometer	2	0		
1 „ „ tangent scale	1	12		
1 „ „ fore-sight and strap ...	0	11		
1 tampeon	1	7		
			220	2
Forage (if carried)	...		33	0
Total	...		389	2
Carriage Camel.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
1 carriage, with elevating gear	237	14		
1 carriage bearer	7	0		
1 chase bearer	6	8		
1 check rope	5	0		
2 spanners	2	8		
			258	14
Forage (if carried)	...		33	0
Total	...		427	14
Axle Camel.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
1 axletree	86	3		
1 trunnion block	10	13		
1 worm wadhook	0	15		
1 grease box	1	12		
2 boxes, ammunition, Clarkson's	18	0		
Containing—				
Near box.—1 axle bolt, 2 case shot, 4 cartridges in covers, 1 cartouche, 1 reciprocating sight-socket, 1 gas ring, 2 lanyards, scissors, 1 drag-washer, 1 leather funnel	27	0		

CAMEL EQUIPMENT—*continued.*

	Weight. lb.	oz.	Weight. lb.	oz.
Off box.—2 case shot, 1 claw hammer, 9-inch McMahon spanner, 1 oil can, ½-pint, 1 axle clip, 1 gas ring, 1 reciprocating sight, 5 boxes friction tubes, 1 holdall, containing 2 common spikes, 2 spring spikes, 1 gas ring lever, 1 clasp knife with marline-spike, 1 oz. silk, 4 needles, magazine	26	5		
			171	0
Forage (if carried)	...		33	0
Total	...		340	0
WHEEL CAMEL.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
2 wheels	215	0		
2 water brackets, canvas	1	4		
1 box for star shell	12	0		
Containing—				
3 star shell, 3 cartridges, 6 oz.; 1 cartouche, 1 box wooden fuzes, 3 bits, hook-borer; 1 cylinder, 1 handle hook-borer, 1 hook hook-borer	23	9		
			251	13
Forage (if carried)	...		33	0
Total	...		420	13
AMMUNITION CAMEL.				
Harness, saddlery, with covers, and cradle...	...		136	0
Load.				
2 ammunition boxes { near	22	13		
{ off	24	10		
Containing—				
1 box for sundries, 1 R.L. fuze box, 1 fuze, 2 cartouches; 1 fuze key, Armstrong; 16 cartridges, 2 case shot, 4 common shell, 10 shrapnel shell, 12 time and percussion fuzes	157	1		
			204	8
Forage (if carried)	...		33	0
Total	...		373	8

CAMEL EQUIPMENT—*continued.*

	Weight. lb.	oz.	Weight. lb.	oz.
ARTIFICER CAMEL, NO. 1.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
2 Clarkson's boxes, artificers'...	51	0		
Tools, smiths' ... ... sets	74	0		
" farrier and shoeing-smith ... "	46	0		
2 holdalls for artificers' tools	5	0		
2 sets extra tools for holdalls	30	0		
			206	0
Forage (if carried)	...		33	0
Total	...		375	0
ARTIFICER CAMEL NO. 2.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
2 Clarkson's boxes, artificers'...	51	0		
1 keg soft soap...	28	0		
Tools, collar-makers' ... ... set	20	0		
2 holdalls, artificers' tools	5	0		
2 sets extra tools for holdalls	24	0		
			128	0
Forage (if carried)	...		33	0
Total	...		297	0
ARTIFICER CAMEL NO. 3.				
Harness, saddlery, with covers and cradle ...	...		136	0
Load.				
2 Clarkson's boxes, artificers'	51	0		
Tools, wheelers' ... ... set	27	0		
2 holdalls, artificers' tools	5	0		
2 set extra tools for holdalls	20	0		
			103	0
Forage (if carried)	...		33	0
Total	...		272	0
PIONEER CAMEL.				
Harness, saddlery, with covers and cradle ...	...		98	0
Load.				
2 racks, intrenching tool, complete	147	9		
10 field pickets...	42	8		
2 picketing ropes	52	8		
			242	9
Forage (if carried)	...		33	0
Total	...		373	9



The remainder of the battery viz 54 Gunners 7 Artificers the head camel man and 2 spare horses are fallen in in rear of the battery.

M *Major*
C *Captain*
S *Subaltern*
⊥ *Sgt Major*
Q *Qr Mr Sgt*

F *Farrier.*
X *Trumpeter*
S. Smith
(P) *Pioneer Tools*

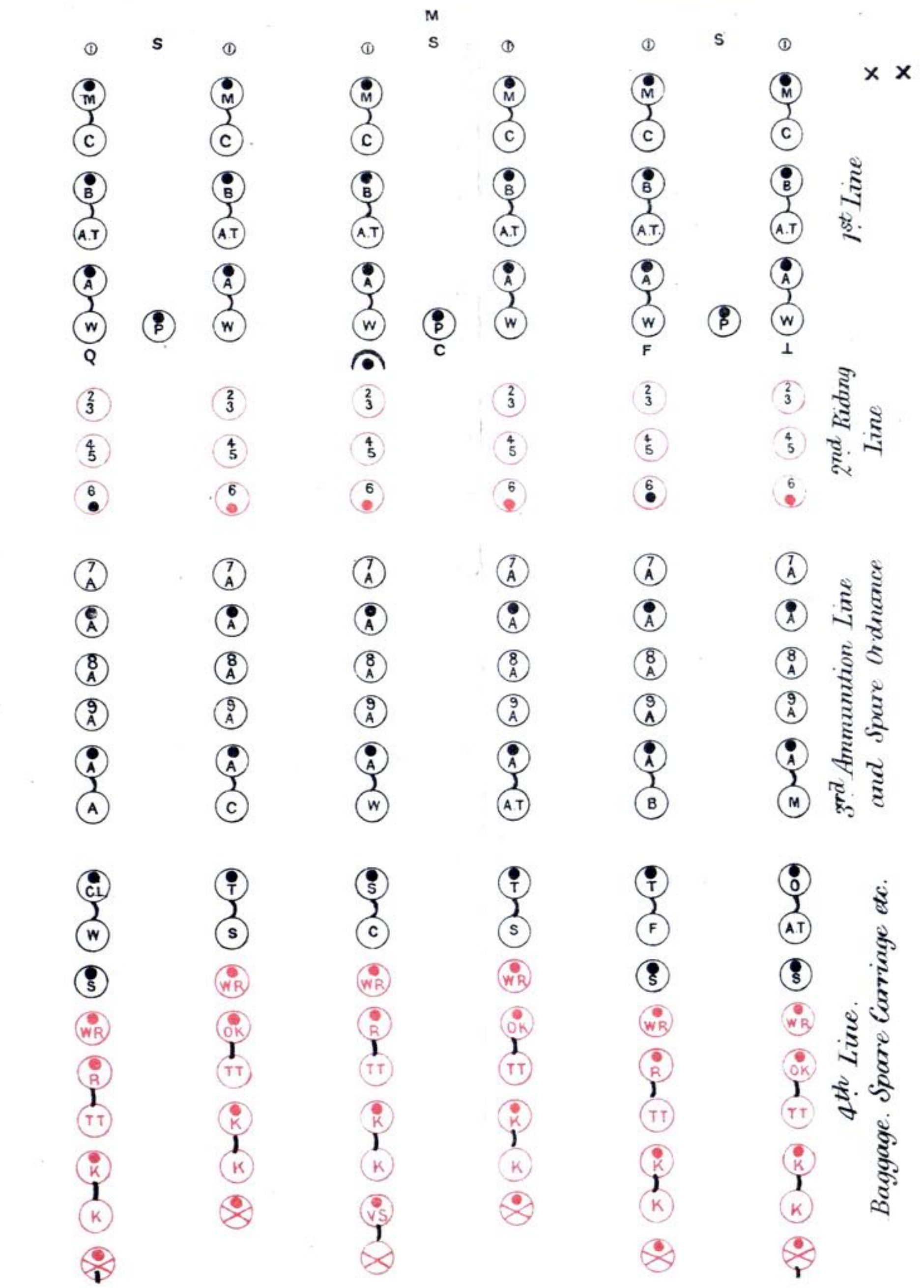
① *No 1. 1. 2. 3 etc Gun detachment*

● ∴ *Camel drivers.*

(M) *Muzzle Camel*
(B) *Breech " *
(C) *Carriage " *
(AT) *Axletree " *
(W) *Wheel " *

(F) *Forge " *
(T) *Artificers " *
(A) *Ammunition " *

(S) *Stores.*
(O) *Office.*
(CL) *Charcoal.*
(WR) *Water.*
(OK) *Officers Kits.*
(K) *Mens "*
(R) *Cooking pots and rations.*
(TT) *Tents.*
(VS) *Veterinary Stores.*
⊗ *Spare.*



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M *Major*
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(A) *Ammunition ,,*

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(K) *Mens ,,*
(R) *Cooking pots and rations.*
(TT) *Tents.*
(VS) *Veterinary Stores.*
⊗ *Spare.*

CAMEL EQUIPMENT—*continued.*

	Weight. lb. oz.	Weight. lb.	oz.
FORGE CAMEL.			
Harness, saddlery, with covers and cradle ...	...	136	0
Load.			
1 forge, mountain, complete	...	221	8
Forage (if carried)	...	33	0
Total	...	390	8

FORMATION OF THE BATTERY, &c.

On "Boot and saddle" being sounded, the gunners, except limber gunners, assist the drivers to saddle and get ready the camels; and when "Fall in" is sounded, the battery falls in by subdivisions, and each subdivision is inspected by its No. 1. The drivers then proceed to the stables or lines in charge of the Nos. 1, load up the line gear loads, and get ready to file out. The gunners are marched to the gun-park by the quartermaster-sergeant, the guns are run out, the ammunition boxes placed on the ground in pairs ready for loading, commencing 5 yards in rear of the guns, and the remaining loads arranged by pairs in the most convenient position. When "Turn out" is sounded the camels are marched to the parade ground by the officer on duty, or in his absence the sergeant-major, the ammunition and pioneer loads are put on by the detachments, under the superintendence of the Nos. 1, and the baggage loads by the spare numbers, under the superintendence of the quartermaster-sergeant. As soon as the ammunition loads are on, the detachments fall in on their guns; the sergeant-major then gives the word "Front limber up," the guns are limbered up in the usual manner, and all the camels proceed to their places in line, the detachments falling in in front by word of command from the Nos. 1. The subaltern officers then inspect their divisions on foot, and the battery is told off and proved by the captain or officer on duty, as laid down for a Field Battery.

The first line consists of the five gun and carriage camels, and the first ammunition camel, the second line of the riding camels, the third line of the remaining ammunition camels, and the spare ordnance camels, and the fourth line of the artificer, store, spare carriage and baggage camels. If there is no riding line the third line becomes the second, and the fourth becomes the third. The officers fall in as laid down for a Field Battery.

Distances and Intervals.

In line a distance of 1½ yards is maintained from nose to croup of the camels of each line, and a distance of 8 yards between lines. In column of route the distance between lines is reduced to 1½ yards; but it is advisable, in order to reduce the length of the column, to march,

where practicable, in column of divisions; this can be done on any road of ordinary width. Detachments before moving off in column of route form the "order of march," and the spare numbers are distributed at intervals amongst the baggage camels in order to assist in adjusting any loads that get out of place, and in tightening or letting out the breechings when required.

The intervals between subdivisions in line are—

Full		19 yds.
Half		9½ "
Close		4 "

Movements in the Field.

The normal pace of manœuvre for Camel Batteries is the "walk," but, if neccessary, on an emergency, the pace can be increased to a "trot." As a rule, the first line only will manœuvre. Drill movements for a Camel Battery correspond to those laid down for a Field Battery; camels "reverse" and "take ground" on their own ground; in "taking ground," with "detachments front," detachments wheel to the right or left.

GUN DRILL, AS FOR MULE EQUIPMENT.

To limber up (see Fig. 3).

Officer.	No. 1.
Front limber up.	Front limber up. Lift.

Limbering up is, as a rule, done only to the front. At "Limber up," the camels are brought up at a trot from the rear, and made to kneel down as follows:—

Chase and carriage camels 3 yards on the right of the axle.
Breech and axle camels 3 yards on the left of the axle.
Wheel and ammunition camels 3 yards in rear of the trail.
The gun is limbered up by a series of 3 separate lifts.

1st Lift.

The dismounting block having been placed by No. 1, one yard in front of the muzzle, the capsquares are removed by Nos. 2 and 3, who bear down on the muzzle, the shifting bar is passed through the cascable by No. 4. No. 1 gives the word "Lift," Nos. 2 and 3 lift at the muzzle, Nos. 4 and 5 at the breech; the gun is lifted out of the trunnion holes, and placed vertically in the dismounting block. No. 2 unscrews the junction nut, No. 3 using the hammer to start it, if necessary, the trunnion block having been placed on the trunnion by No. 2. No. 4 steadies the muzzle portion, No. 5 the breech.

N.B.—In soft ground the dismounting block is placed on the trail plate.

2nd Lift.

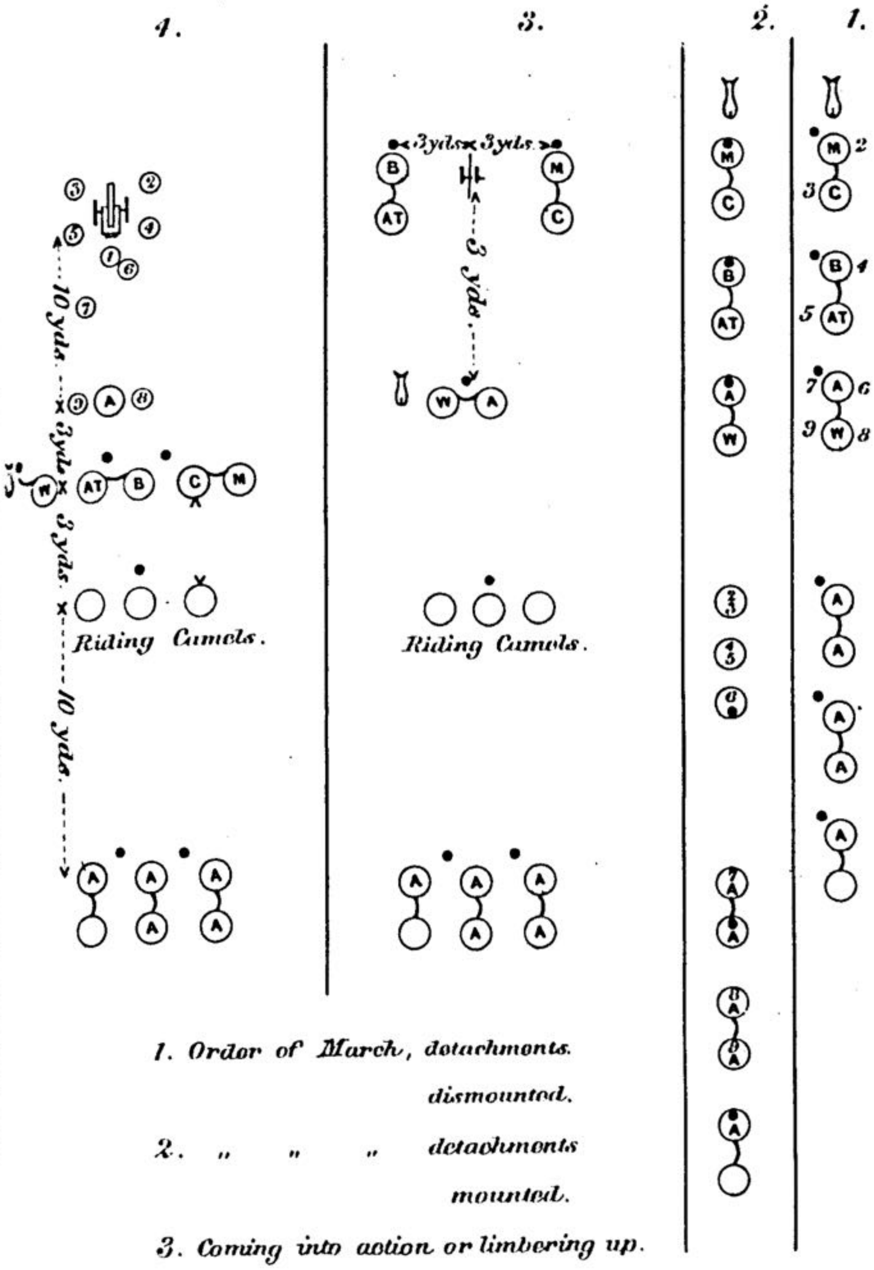
No. 3 brings up and adjusts the chase bearer.*

Nos. 2, 3, and 4 lift the chase off the breech and place it on the chase camel; No. 2 replaces the bearer.

* If a chase fid is used, it is placed in the bore by No. 1.

To face page 54.

CAMEL EQUIPMENT.
GUN AND DETACHMENT.



1. *Order of March, detachments dismounted.*
2. *" " " detachments mounted.*
3. *Coming into action or limbering up.*
4. *In action.*

Dangerfield Lith 22. Bedford St Covent Garden. 14838

CAMEL EQUIPMENT—*continued.*

No. 1 places the breech bearer in the bore, gives the word "lift," and the breech is then lifted by Nos. 1, 5, and 6, and placed on the breech camel, No. 6 withdrawing and replacing the shifting bar.

3rd Lift.

The capsquares having been replaced, and the axle clips removed by Nos. 8 and 9, No. 7 gives the word "Lift;" Nos. 7, 8, and 9 lift the carriage; No. 8 passes the carriage bearer under the breast to No. 9, No. 7 lifts at the point of the trail, and the carriage is placed on the carriage camel. No. 8 withdraws and replaces the carriage bearer. Nos. 2 and 3 then remove the linch-pins and washers, Nos. 2 and 8 lift the right, Nos. 3 and 9 the left wheel off the axle and them on the wheel camel. Nos. 6 and 7 place the axle, and No. 5 the trunnion block on the axle camel. No. 4 places the dismounting block on the breech camel.

General Duties in Limbering up.

No. 1 commands, places dismounting block, places and lifts at bearer in placing breech on camel.

No. 2 removes right capsquare, bears down on muzzle, lifts gun to dismounting block, supplies himself with trunnion block, places it on left trunnion, if hammer is used, unscrews junction nut, lifts at right of chase bearer, buckles chase strap, and replaces bearer, removes right linch pin and washer, and lifts in front of right wheel.

No. 3 removes left capsquare, bears down on muzzle, lifts gun to dismounting block, supplies himself with hammer, and hammers left trunnion if necessary, adjusts chase bearer, and lifts at left of it, buckles chase strap, removes left linch pin and washer, and lifts in front of left wheel.

No. 4 passes shifting bar through cascable, lifts gun to dismounting block, steadies muzzle, lifts chase at muzzle, straps on sponge and rammer, and replaces dismounting block and hammer.

No. 5 lifts gun to dismounting block, steadies breech, lifts at left of shifting bar, buckles breech strap, replaces trunnion block.

No. 6 lifts at right of shifting bar, buckles breech strap, withdraws and replaces shifting bar, lifts and straps on axle.

No. 7 lifts at point of trail, lifts and straps on axle.

No. 8 throws off right clip, passes bearer under carriage to No. 9 and lifts at right of it, buckles rear carriage strap, lifts in rear of right wheel and replaces carriage bearer.

No. 9 throws off left clip, lifts at left of carriage bearer, buckles front carriage strap, lifts in rear of left wheel and buckles wheel strap.

In loading, the chase is reversed to the left, the breech to the right, the numbers facing to the rear.

Position of detachment when in order of march (see Figs. 1 and 2):—

No. 1. Three yards in front of chase camel (mounted).
No. 2. One yard on right of chase camel.
No. 3. One yard on left of carriage camel.
No. 4. One yard on right of breech camel.
No. 5. One yard on left of axle camel.
No. 6. One yard on right of 1st ammunition camel.
No. 7. One yard on left of 1st ammunition camel.
No. 8. One yard on right of wheel camel.
No. 9. One yard on left of wheel camel.

CAMEL EQUIPMENT—*continued.*

In Changing Rounds when in Order of March.

No. 9	becomes	No.	7
No. 7	"	"	5
No. 5	"	"	3
No. 3	"	"	1
No. 1	"	"	2
No. 2	"	"	4
No. 4	"	"	6
No. 6	"	"	8
No. 8	"	"	9

From the Order of March, to form Detachment Front.

Officer.	No. 1.
Detachment front.	Double March. Halt, front.

No. 1 places himself 5 yards in front of the chase camel, and 2 yards to the right. He gives the word "Double march;" the remaining numbers double up, Nos. 2 and 3 closing to three paces and wheeling to right opposite No. 1, the odd numbers covering No. 3, and the even numbers No. 2. When all have closed up, No. 1 gives the word "Halt," "Front," and the detachment halts, turns to the front and dresses by the right.

From Detachment Front, to form the Order of March.

Officer.	No. 1.
Form the Order of March.	Left turn. Double March.

The detachment turns to the left, wheels to the left, and the numbers double to their places in the order of march, halt, and turn about with the highest number.

From the Order of March, to come into Action (see Fig. 3).

Officer.	No. 1.
"Action Front."	"Action Front." "Lift."

Coming into action is, as a rule, done only to the front.

On the command "Action front," No. 1 dismounts and gives his horse to the first ammunition camel-driver, the chase and carriage camels remain stationary, the breech and axle camels are brought up 6 yards to the left of, and in line with the chase and carriage camels, the wheel and ammunition camels to 3 yards in rear of the same position, and all are made to kneel down.

The bearers and shifting bar are placed on the ground clear of the wheels on their own sides as soon as removed after mounting the gun.

CAMEL EQUIPMENT—*continued.*

If detachments are mounted, the riding camels are made to kneel, the detachments dismount at the word "Action front," and the camels are left in charge of the 2nd line camel-driver.

Coming into action is the converse of limbering up, and is performed by a series of three lifts.

As soon as the loads are removed, the camels are made to rise, reverse outwards, and move to their position in action. Nos. 8 and 9 take charge of the first ammunition camel, and make it kneel 10 yards in rear of the trail eye; the remaining camels move to their positions in "Action," and kneel.

1st Lift.

At the word "Lift," Nos. 6 and 7 take off the axle and hold it on the left of the carriage camel, Nos. 2 and 8 take off the right, and Nos. 3 and 9 the left wheel, and place them on the axle; Nos. 7, 8, and 9 lift the carriage and place it on the axle, No. 7 lifting at the point of the trail, and No. 8 unshipping and passing the bearer to No. 9. Nos. 8 and 9 fasten the clips; Nos. 2 and 3 put on linch pins and washers; No. 4 brings up the dismounting block, and No. 5 the trunnion block.

2nd Lift.

No. 5 unships and places the shifting bar; No. 1 gives the word "Lift," Nos. 1, 5, and 6 lift the breech, and place it vertically in the dismounting block; No. 1 removes bearer from bore, and wipes screw with oil rag; No. 3 unships and places chase bearer; Nos. 2, 3, and 4 lift the chase and place it on the breech, the feather being fitted into the recess, and the faces of the two parts brought evenly together; No. 3 removes the chase bearer;* No. 2 screws up the junction nut, using the hammer, if necessary; and No. 3 placing the trunnion block, No. 4 steadies the muzzle portion, No. 5 the breech. When the lines on the breech and nut correspond, No. 1 gives the word "Home."

3rd Lift.

At the word "Lift," from No. 1, Nos. 4 and 5 lift at the breech, Nos. 2 and 3 at the muzzle. The gun is lifted into the trunnion holes, Nos. 2 and 3 fix capsquares, No. 4 withdraws the shifting bar from the cascable, and all the numbers take their places for "Action."

General Duties on coming into Action.

No. 1 commands, lifts at breech bearer, wipes screw, and removes it from bore.

No. 2 casts off rear chase strap, lifts in front of right wheel, and puts on right linch pin and washer; lifts at right of chase bearer, screws up junction nut, strikes trunnion block with hammer if necessary, lifts gun into trunnion holes, and places right capsquare.

No. 3 casts off front chase strap, lifts in front of left wheel, and puts on left linch pin and washer, places and lifts at left of chase bearer, removes it, places and holds trunnion block, if required, with his left hand, lifts gun into trunnion holes, and places left capsquare.

* If a chase fid is used, it is withdrawn by No. 1.

CAMEL EQUIPMENT—*continued.*

No. 4 brings up dismounting block, lifts at muzzle, and steadies chase while being screwed up, lifts gun into trunnion holes, removes shifting bar, unbuckles sponge and rammer, and places them outside wheels.

No. 5 brings up trunnion block, places shifting bar, casts off front breech strap, lifts at left of shifting bar, and lifts gun into trunnion holes.

No. 6 takes off and places axle, casts off rear breech strap, lifts at right of shifting bar, ships the handspike.

No. 7 takes off and places axle, lifts at point of trail.

No. 8 lifts in rear of right wheel, casts off rear carriage strap, passes bearer under carriage to No. 9, and lifts at right of it; removes it, fixes right clip, and removes right capsquare.

No. 9 casts off wheel strap and lifts in rear of left wheel, casts off front carriage strap, lifts at left of carraige bearer, fixes left clip, and removes left capsquare.

In drilling with reduced numbers, the wheels are lifted by Nos. 2 and 3, without assistance, Nos. 5 and 6 performing the duties of 8 and 9.

THE CAMEL.

The following remarks are compiled partly from Colonel Furse's work on *Military Transport*, and partly from the personal experiences of several officers in recent campaigns.

Nature.—Camels may be divided into two species—the Arabian, or one-humped, and the Bactrian, or two-humped. The latter are very scarce in India or Egypt, being principally found in cold climates. The Arabian camel is found all over India and Egypt, and the species may be divided into the Scinde or Plain camel, and the Afghan or Hill camel. All the camels found south of the Indus may be classed as the Scinde variety, and distinguished by the absence of hair, or by a comparatively smooth skin. Some of the Scinde males are magnificent-looking animals, with great length of leg and proportionate appearance of strength. The Scinde variety like the heat and dryness of the plains; it is their nature to traverse sandy deserts, and they are very susceptible to severe cold. The Afghan camel, on the contrary, is in general a smaller animal, not so long in the leg, is often covered with a thick coat of hair, and is not nearly so susceptible to climatic changes. The weight of a full-grown Scinde camel is about 10 cwt., his average length from nose to tail 8 feet, and his ordinary height 7 feet to top of hump.

The camel sometimes lives from 30 to 40 years.

The ordinary transport camel is one of the most quiet, most long-suffering, and most enduring of animals. He is easily fed, easily looked after, comparatively inexpensive to keep, and admirably adapted for a pack animal. Nature has constituted the camel a beast of burden. The horny pads, or callosities, on his elbows, breast, and stifles, serve to protect the skin when he "sits" to receive the load. His arched back and flat-ribbed sides appear specially formed to receive a load; and the foot, with its elastic and thick sole, can accommodate itself to loose sandy soil, or hard and rough ground.

CAMEL EQUIPMENT—*continued.*

The camel is not harassed by extreme heat to the same extent as other pack animals, but as marching in the sun fatigues him, and as he can do with little sleep, in making long marches he should be worked, when possible, mainly at night.

Young camels are unfit for rough, continuous work, and all camels, as a rule, are in a bad condition for hard work during the time they are shedding their coats.

They should not be used for severe work before their fourth or fifth year.

The camel is usually quiet under fire, and appears, at the time, to be unaffected by bullet wounds except when struck in a vital part.

Food.—The favourite food of the camel is wormwood, thistles, shrubs, and coarse, prickly, and saline grasses.

In many parts of Egypt the ground is covered with edible bushes, and the camel can graze freely on the "Ardeb" and "Mimosa," as well as on the withered grasses which are also frequently found.

The camel should always be permitted to graze when practicable. On the march, however, there may be no convenient time to graze or no foliage to eat, and it then becomes necessary to ration the camel in the same manner as the horse.

When camels cannot be grazed on foliage or plentifully supplied with green food, they should, as a *minimum*, receive the same ration of "bhoosa," grass, "kirbee," and grain as a full-sized horse. Less than this will not enable them to work continuously and keep condition.

When grain is given to camels it should be split or bruised if possible.

It should be borne in mind that the camel ruminates his food, and requires from six to eight hours consecutively to do so properly.

He receives no injury to his palate from the thorns and hard food which he eats, but, being a naturally slow feeder, he requires plenty of time to graze.

Sometimes fodder in sufficient abundance cannot be found in the immediate vicinity of the camp, and the camels have to be taken off several miles to graze after they have completed their day's march.

The drivers do not relish this, and unless they are well looked after, they drive the animals back to camp before they have taken in nourishment at all commensurate with the hard work they have to undergo.

Drink.—One of the most remarkable peculiarities of the camel is his internal power of conveying a supply of water. His stomach is provided with a pouch-like appendage, in which water can be stowed away, but this admirable provision of nature has often been fatal to the unfortunate animal. He has got the credit of being able to do without water, whereas the camel requires his daily drink just the same as any other animal. It does not at all follow that when camels are watered they will fill their internal reservoirs as well as quench their thirst. They may or may not do so. It depends upon a variety of circumstances, such as the temperature of the water, the frequency with which they have lately been supplied with water, the time given to watering, &c. Indeed, it is a well-known fact that native camel owners who are well acquainted with the habits of the animal specially train the camels employed in caravan work from an early age to march without water, and sometimes pour water down their throats, so as to

CAMEL EQUIPMENT—*continued.*

compel them to take in a supply before starting on a long journey in a waterless country. But if this supply has not thus been previously given, or if the camel has not supplied himself of his own accord, he will suffer from thirst just like any other beast.

Authorities differ in their estimate of the amount of water which the camel can thus stow away, but, as a general average, it may be estimated at from five to six gallons for camels of the Arabian species.

The camel should not be watered after a full meal, but with this exception he may be allowed to drink at any time.

A large camel, taking five or six gallons of water into his stomach, is supposed to remain for five or six days without drinking, but, as above-mentioned, the water which the animal has in his stomach is frequently over-estimated, and it is never safe to put too much dependence on this peculiarity.

Pace.—The highest speed of a lightly-loaded baggage camel is three miles per hour, but as a general rule the pace of the ordinary transport animals is little over two miles an hour.

When in good condition he can keep this up for 15 hours at a stretch with an occasional halt.

The camel dreads ground where the surface is slippery, such as the ascents and descents from and into a wet ditch, and such places are always a source of danger to him. Under these conditions he is liable either to fall or to receive fatal injury by his legs separating suddenly wide apart.

He has been known, however, to cross without apparent difficulty a morass where the mud was from 6 to 18 inches deep with a hard slippery bottom.

Harness.—Camel gear consists of a straw-stuffed saddle or *palan*, fitted with a wooden framework. This is secured on the animal's back by a neck rope, a crupper rope, and a girth or belly rope. There is, in addition, the jhool, the loading rope, the headstall, and the leading rope. The jhool is merely a coarse horse blanket. The loading rope weighs 7 lb. or 8 lb., and is used for lashing and securing the load on the saddle. The headstall is usually a simple rope head collar, and the leading rope is either attached to the head collar or to a slit in the nostril.

Sometimes the headstall is fitted with a separate leading rope attached to it by a short chain.

The camel does not require any picketing gear, but can be hobbled by the driver if necessary.

The stuffing of the saddle and general fitting of the harness should be frequently looked to.

Unless the saddle is of a size suitable to the animal, it is liable to gall him in front of the hip.

Load.—The carrying power of camels depends, of course, on their size and condition. Powerful animals will carry eight maunds (640 lb.), or even heavier loads, without distress, while half that weight will often prove too much for a small or weak animal. As a rule, five maunds (400 lb.) is a fair average load for full-grown animals in good condition.

The Arabian camel used in Aden and Egypt for ordinary transport is only supposed to be capable of carrying 350 lb.

The camel is usually made to crouch or "sit" to receive his load in the following manner :—The driver, standing in front, holds the nose rope in one hand and a stick in the other ; he gives the rope a twitch,

at the same time saying, "*hush, hush,*" and, if necessary, giving one of the fore-legs a tap with the stick. The camel knows well the object in view, and generally protests more or less by grunting or gurgling. At length, however, he drops on his knees, then sits back, and finally tucks his legs under him.

If the camel is a refractory beast, and the driver suspects that he will not receive the load quietly, the arms of the fore-leg are lashed together, so that the animal, thus hobbled, cannot rise. The load should then be lifted on from the rear and lashed securely, care being taken when the load is in two portions that the weight is evenly distributed on each side. On the load being secured and the fore-leg lashing removed, the animal usually rises of his own accord, and stands quietly waiting to take his place in the string. Sometimes, however, he takes the earliest opportunity of practically showing his dislike to becoming a beast of burden, and immediately on rising endeavours to divest himself of his load by a series of ungainly capers, and unless the load is very firmly secured he is generally successful.

Great care must be taken in girthing up, and it is always advisable to tighten girths after loading.

Endurance and Disease.—When properly looked after and treated, the camel is one of the most enduring beasts of burden known. He is, however, a comparatively delicate animal, and when overworked he rarely recovers, as horses and other animals do by rest, but generally becomes daily weaker until he dies.

When a camel ceases to eat, either on the march or in quarters, it is a sure sign that he is ailing. The camels of the plains suffer severely from the cold if taken into the hills in the winter; and *vice versâ*, the hill camels are more harassed by extreme heat.

The plain camel, moreover, is ill-adapted for a hilly country owing to a want of muscular power in the hind legs.

The main cause of mortality among army transport camels is the neglect and indifference of the camel-drivers or "sarwans," whose cruelty and callousness can often scarcely be exaggerated. The worst enemy of the army transport camel is frequently his attendant.

As a rule the camels and native drivers of a camel battery are specially selected, but they both require active supervision on the part of the European establishment.

In cases of exhaustion, when the camel, utterly done, refuses to rise even when unloaded, a good effect has been produced by giving him a bottle of rum.

Sores and galls should always be carefully attended to, dressed with tar ointment, and covered, when practicable, with a piece of canvas or rag to keep off the flies. A gall in its early stage will frequently get well if looked to in time, and if the animal is not worked for a few days; but if it be permitted to develop into a bad sore, the animal will often fall off in condition and take months to get into working order.

The diseases of camels and their treatment when sick appear to be little understood, but the subject has been cleverly dealt with in a pamphlet by Major H. P. Hawkes, Acting Assistant Commissary-General of the Indian Army.

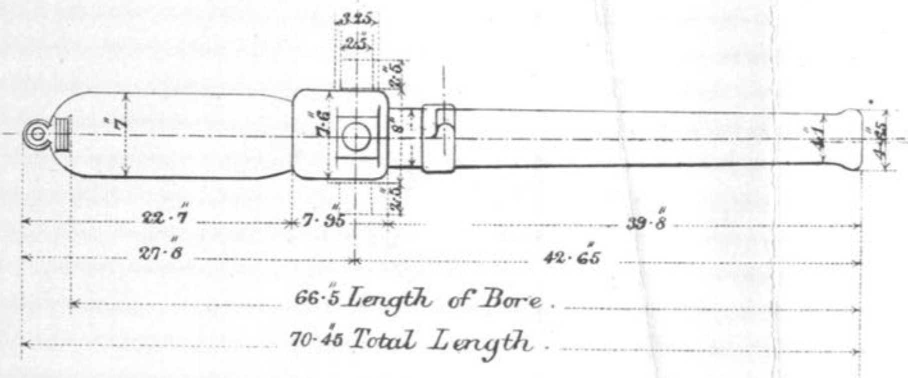
Inflammation of bowels, colic, coughs, colds, sprains, and feverish symptoms may be treated as in the horse.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY HARRISON AND SONS,
PRINTERS IN ORDINARY TO HER MAJESTY.
[Wt. 10828 500 9 | 88 1878]

ORDNANCE. JOINTED R.M.L. 2·5 INCH. MARK I

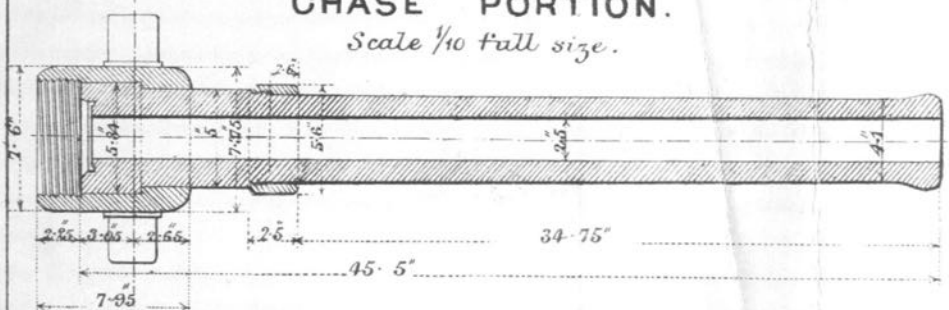
STEEL 400 LB.

Scale, $\frac{3}{4}$ inch = 1 Foot or $\frac{1}{16}$ full size.

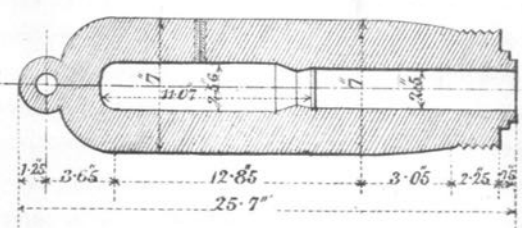


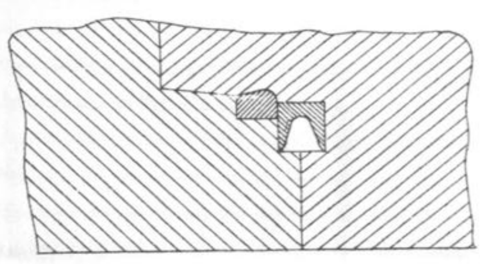
CHASE PORTION.

Scale 1/10 full size.



BREECH PORTION.

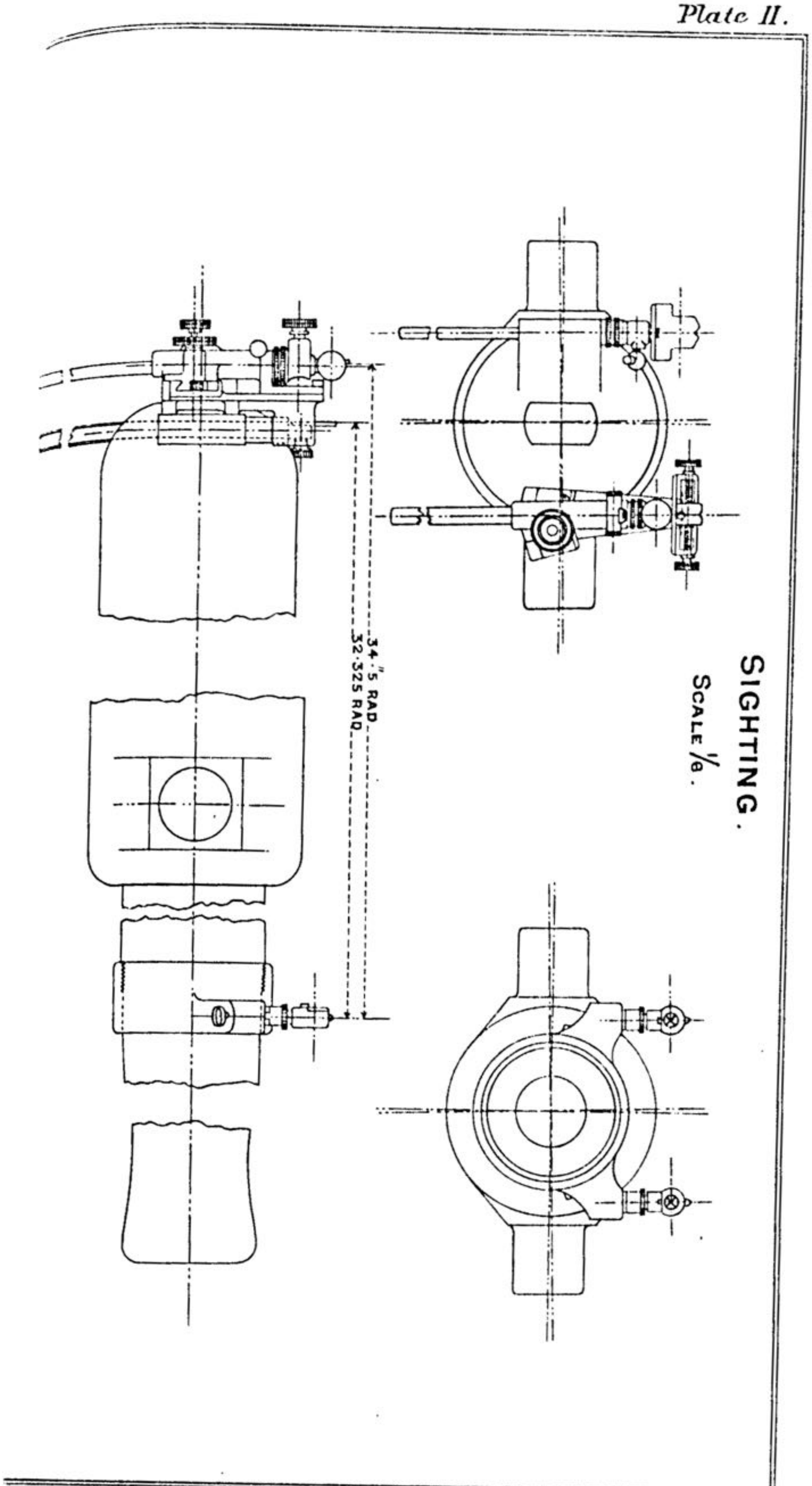




Full size Section at Joint, showing gas ring and ring retaining gas ring.

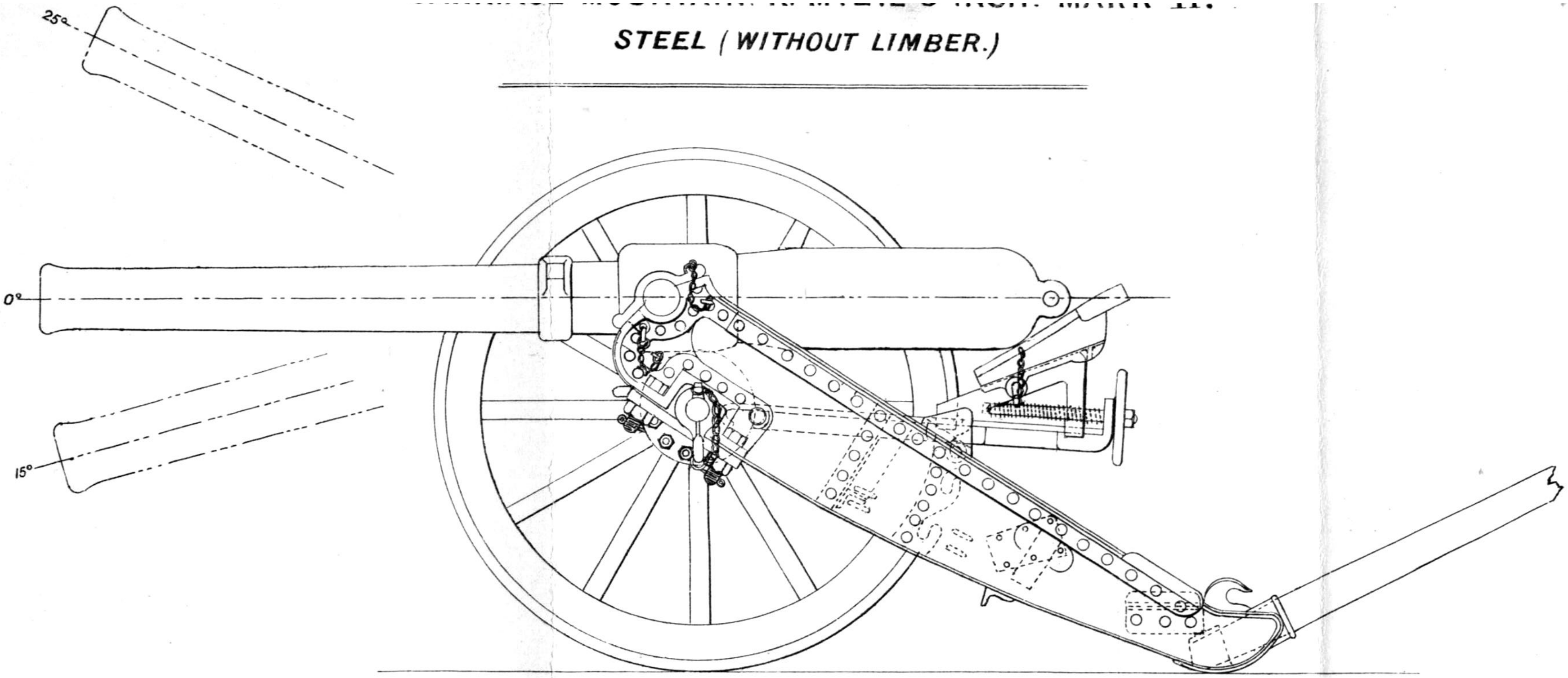
Dangerfield, Lith. 22, Bedford St. Covent Garden. 7279.

Plate II.

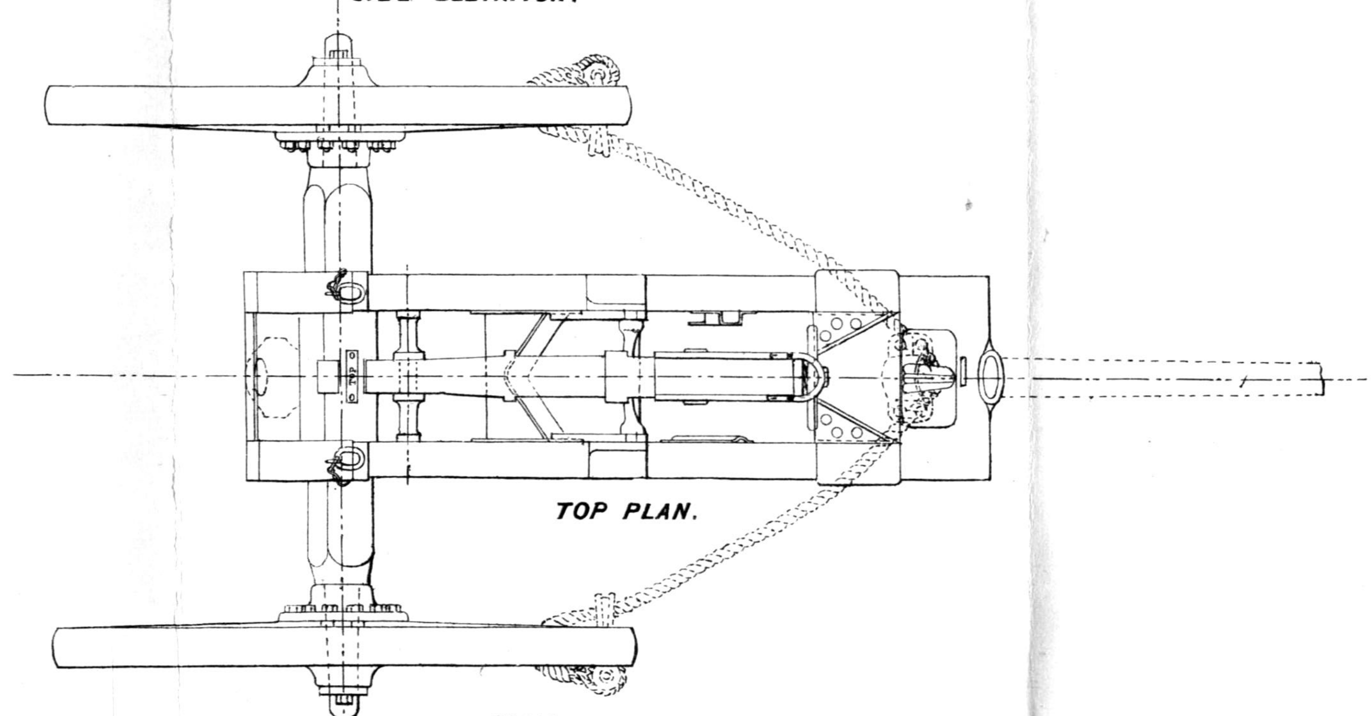


DANGERFIELD, LITH. 22, BEDFORD S^T COVENT GARDEN 13960. 4/87.

STEEL (WITHOUT LIMBER.)



SIDE ELEVATION.



TOP PLAN.

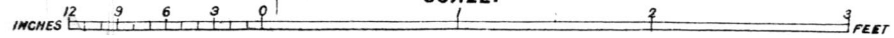
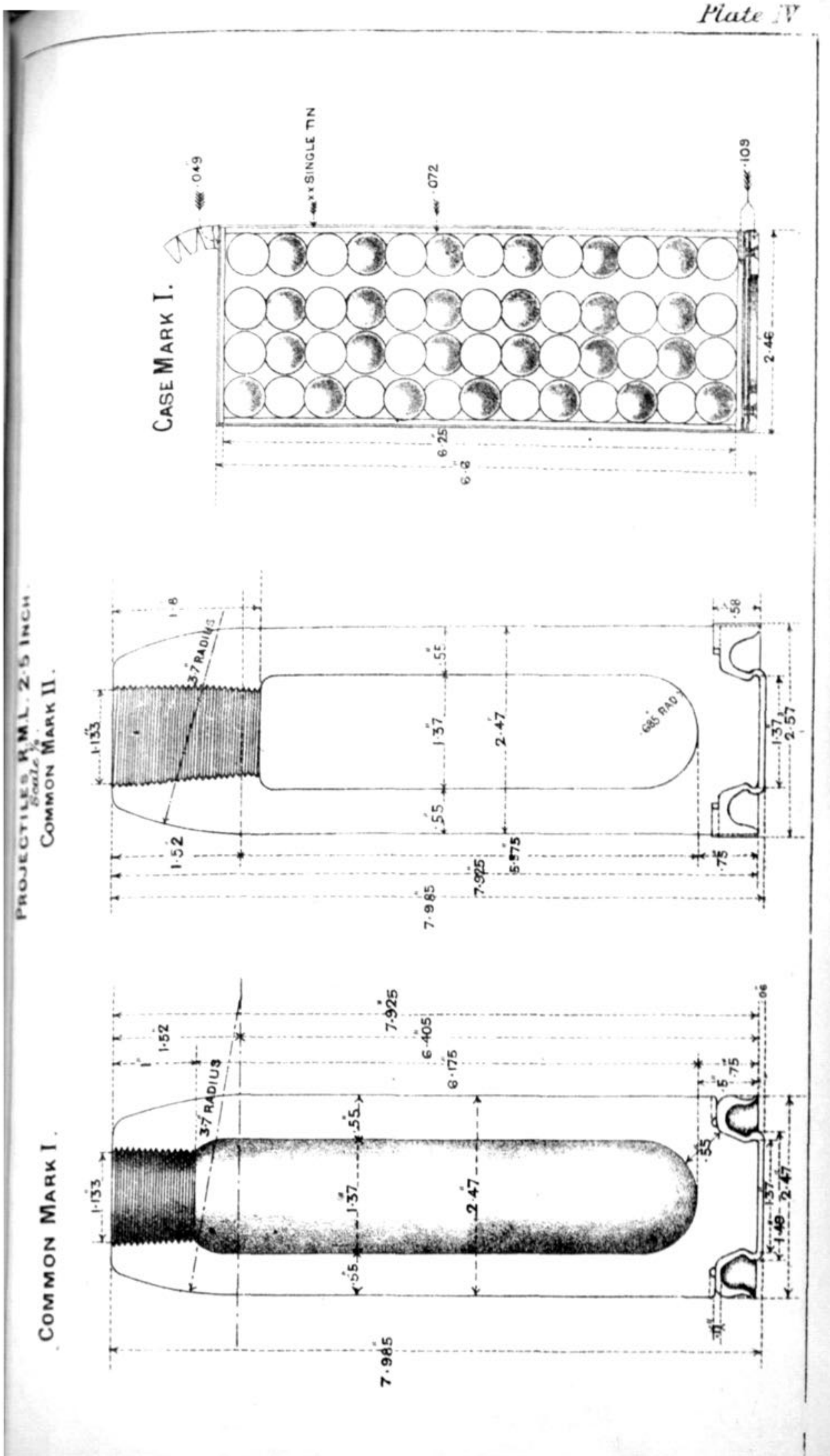


Plate IV



DANGERFIELD LITH 22, BEDFORD ST COVENT GARDEN

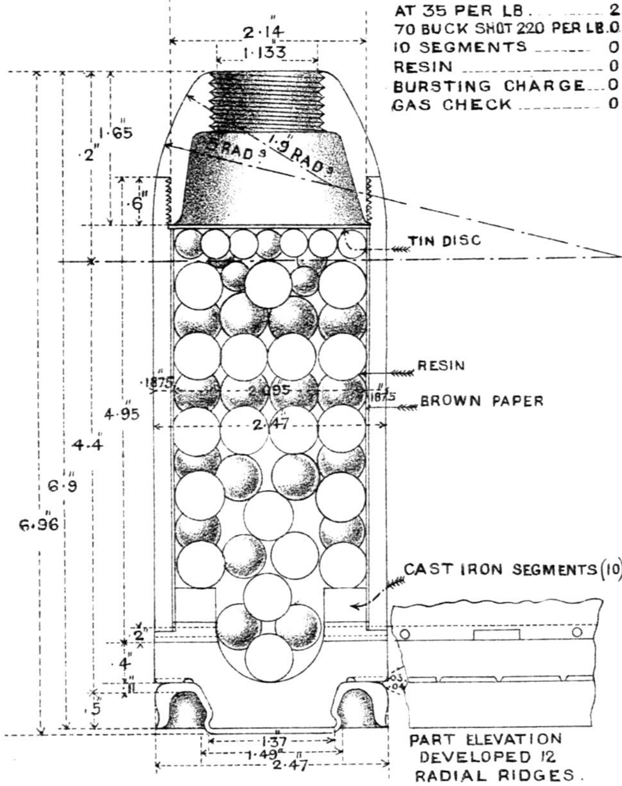
Projectiles R.M.L. 2·5 Inch.

Scale $\frac{1}{2}$.

Shrapnel Mark II.

Average Total Weight - 7 - 0 ± 1·5 P.C. (lb. oz.)

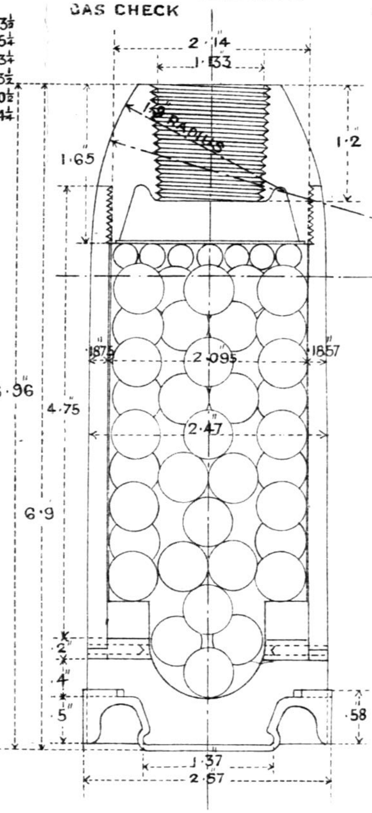
Head	0.10
Tube	1.11¾
Base	0.11¾
Disc tin	0.0½
100 mixed metal balls at 35 per lb.	2.13½
70 buck shot 220 per lb.	0.5¼
10 segments	0.3¼
Resin	0.3½
Bursting charge	0.0½
Gas check	0.4¼



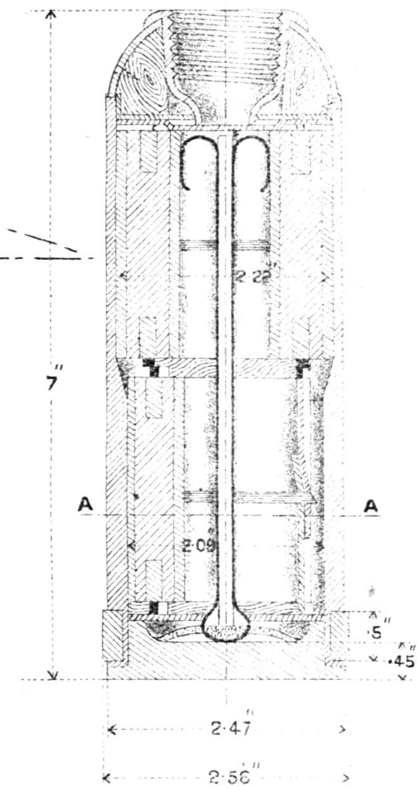
Shrapnel Mark III.

Average Total Weight = 7 - 10 ± 1·5 % (lb. ozs.)

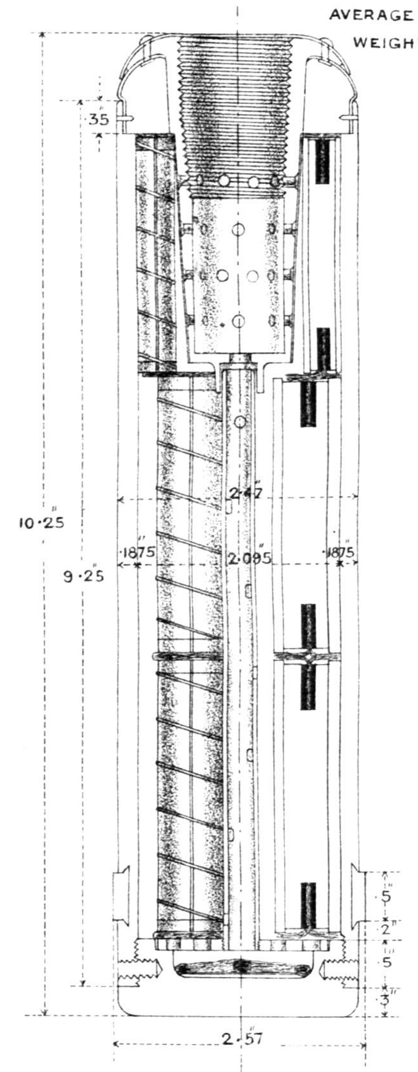
Bursting charge	= 0½
100 mixed metal balls (35 per lb)	2·13½
11 buck shot (220 per lb.)	= 0¾
10 cast iron segments	= 3¼
Gas check	= 6



Star, Armstrong. Mark I.

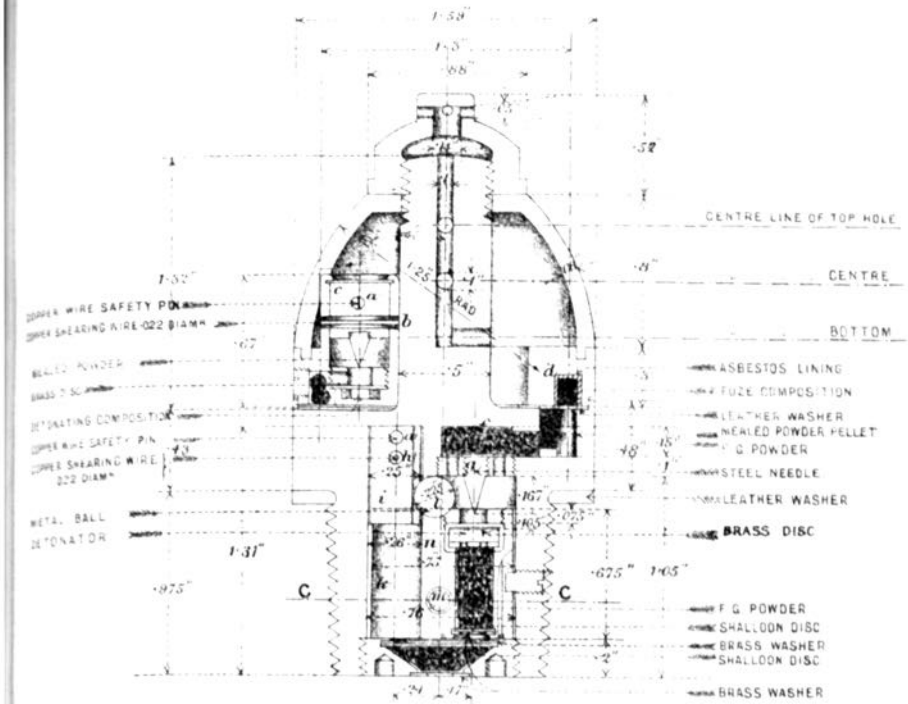


Star. R. L. Mark II.

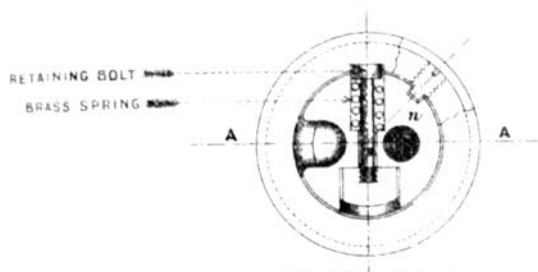


FUZE TIME AND PERCUSSION. SHORT. (MARK I.)

FULL SIZE.



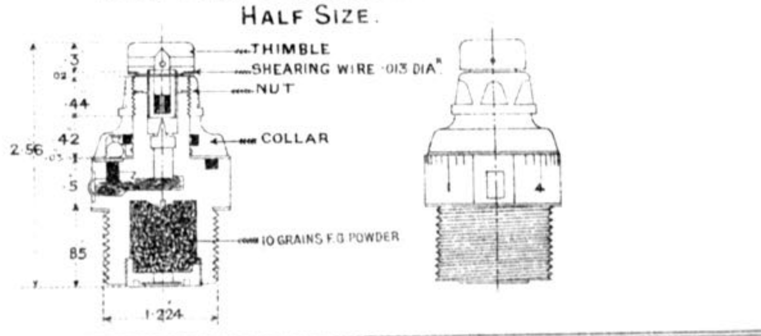
SECTION AT A.A.



SECTION AT C.C.

FUZE TIME AND CONCUSSION SMALL WITH THIN SUSPENDING WIRE.

HALF SIZE.

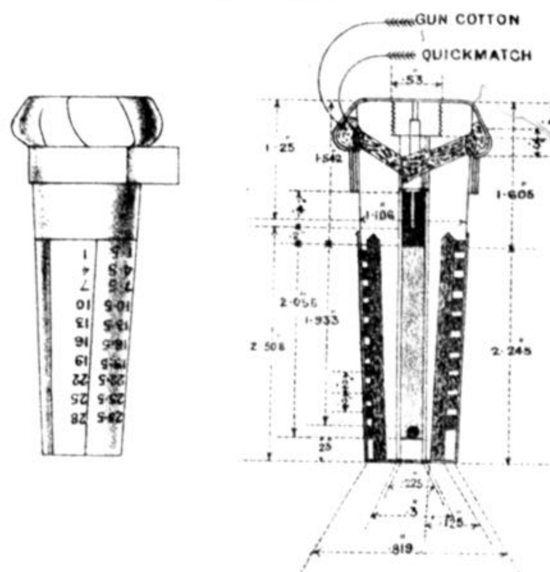


LANCEFIELD LITH. 22 BEDFORD ST COVENT GARDEN. 13960 4/87.

FUZE TIME WOOD M.L. 15 SECONDS.

SPECIAL PRIMING.

HALF SIZE.

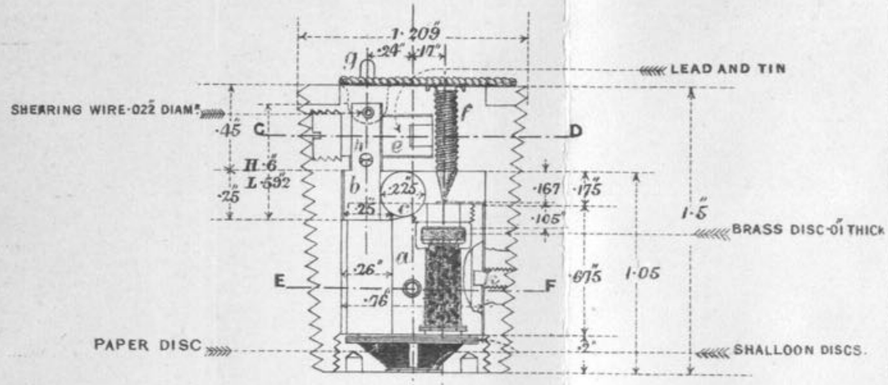


Note: In present and future manufacture the powder channels will be parallel to the axis and not to the sides of the fuze.

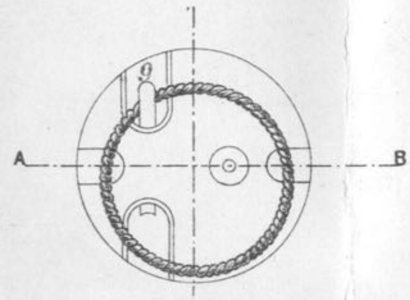
DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 13960. 4/87.

FUZE, PERCUSSION, SMALL. MARK I*

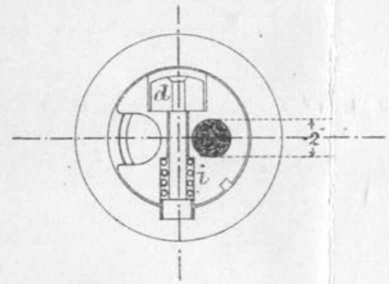
FULL SIZE.



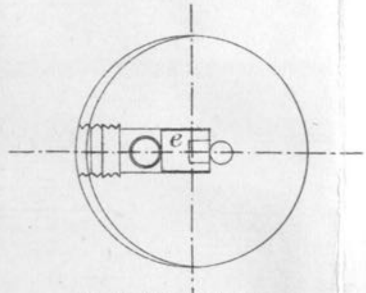
SECTION AT A.B



PLAN.



SECTION AT E.F.

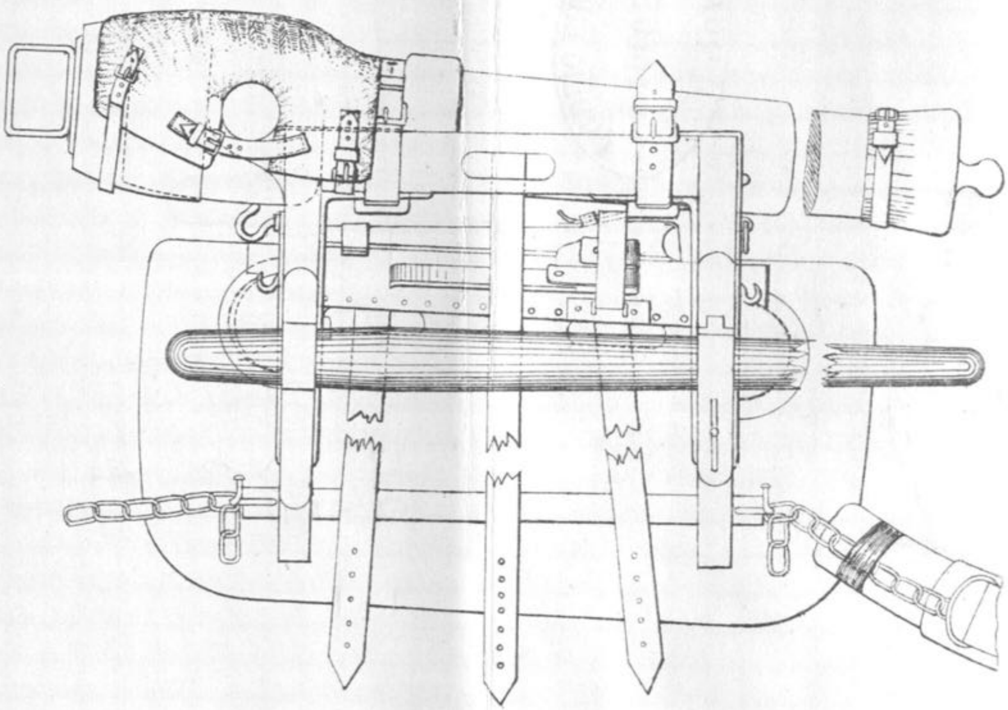


SECTION AT C.D.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 386.11718

R.M.L. 2·5 INCH EQUIPMENT.

GUN CHASE.



BREECH

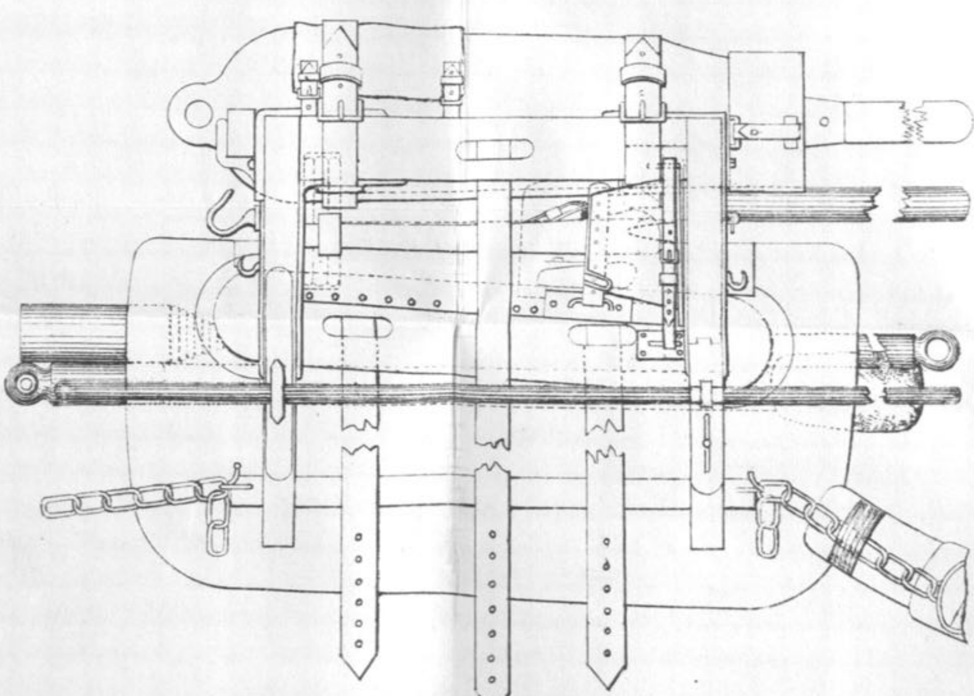
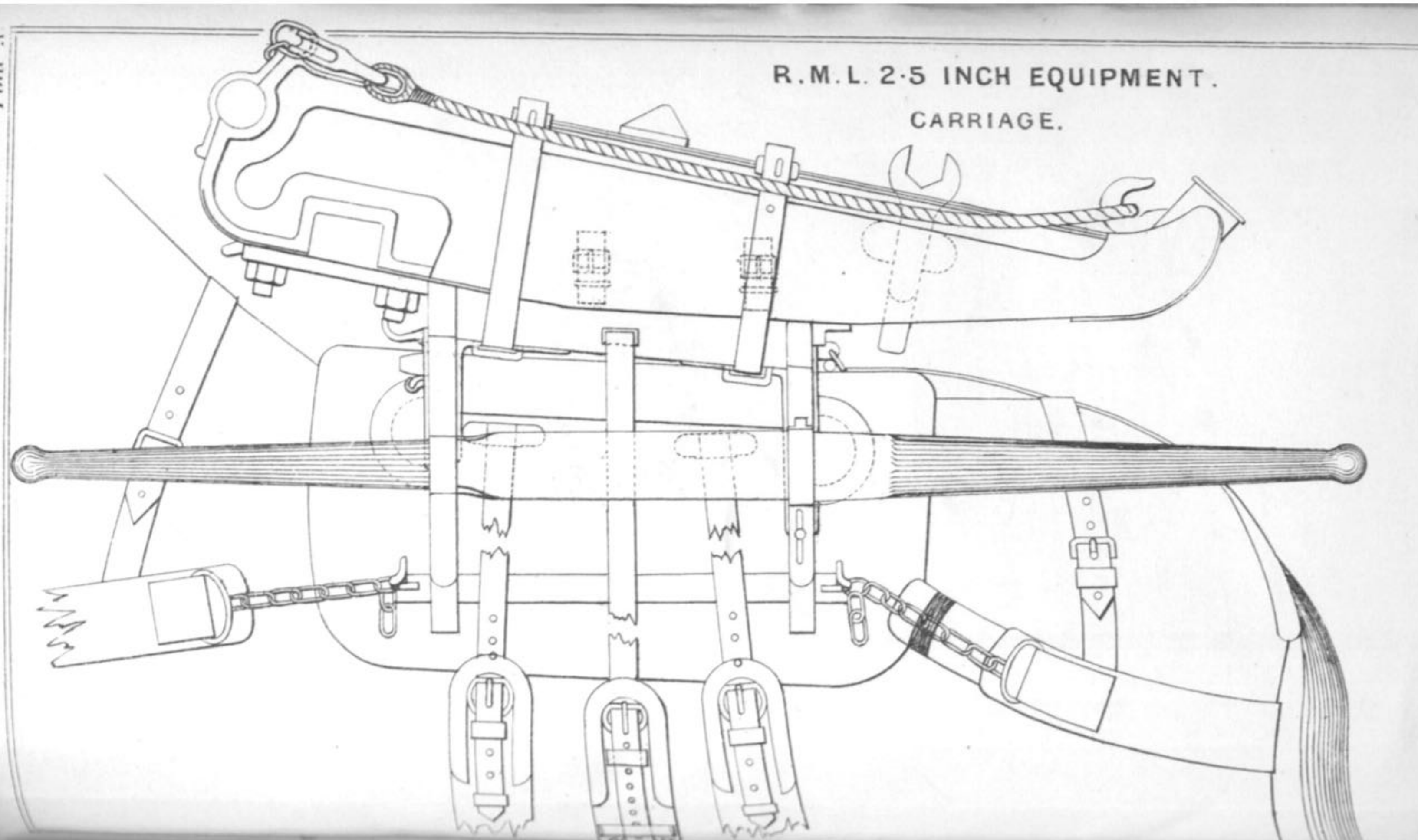


Plate X

R.M.L. 2·5 INCH EQUIPMENT.

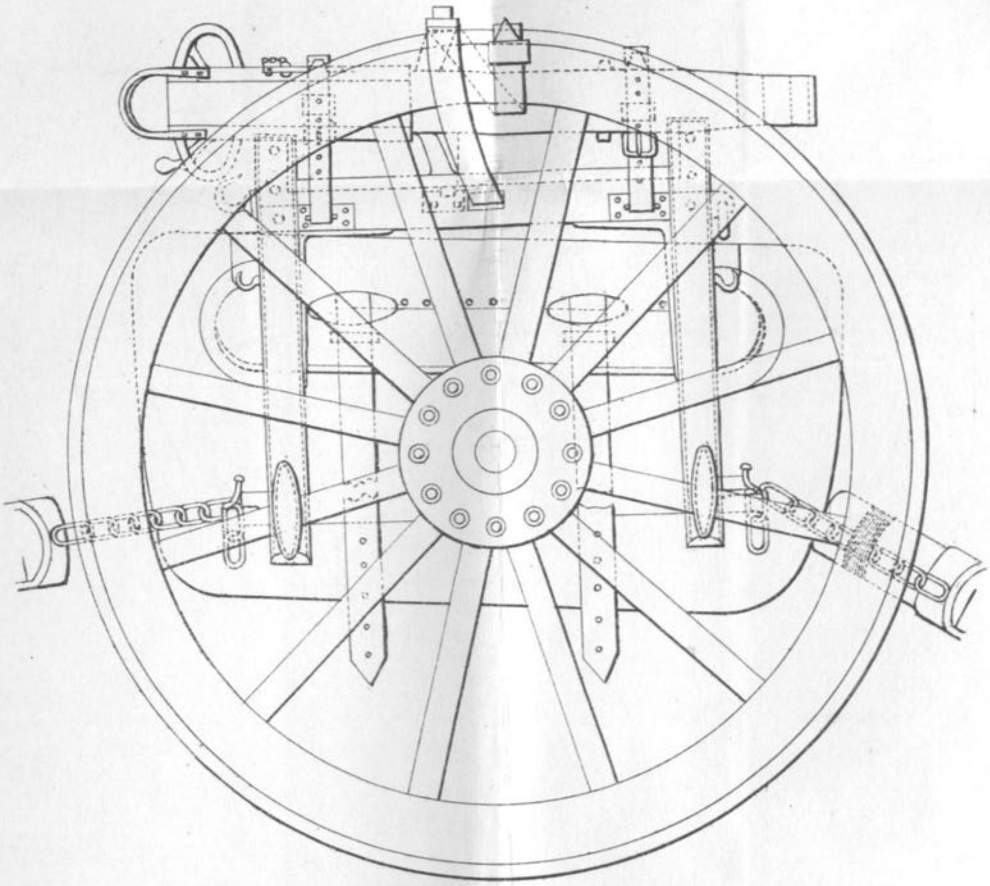
CARRIAGE.



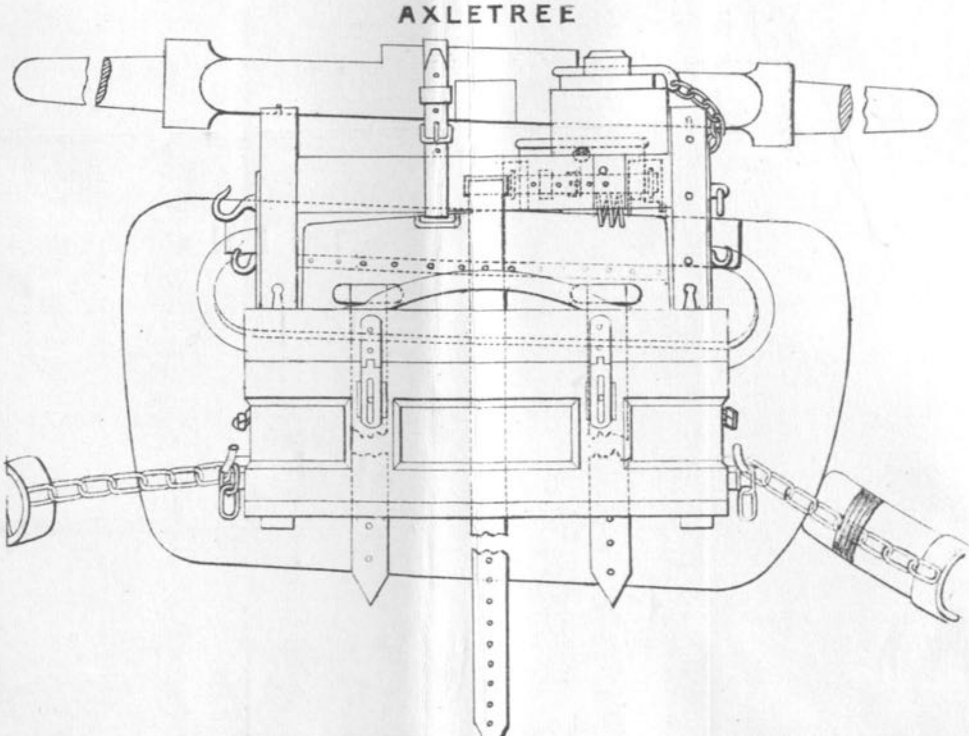
Dangerfield, Lith. 22, Bedford St. Covent Garden. 14888.

R.M.L. 2·5 INCH, EQUIPMENT.

WHEELS.

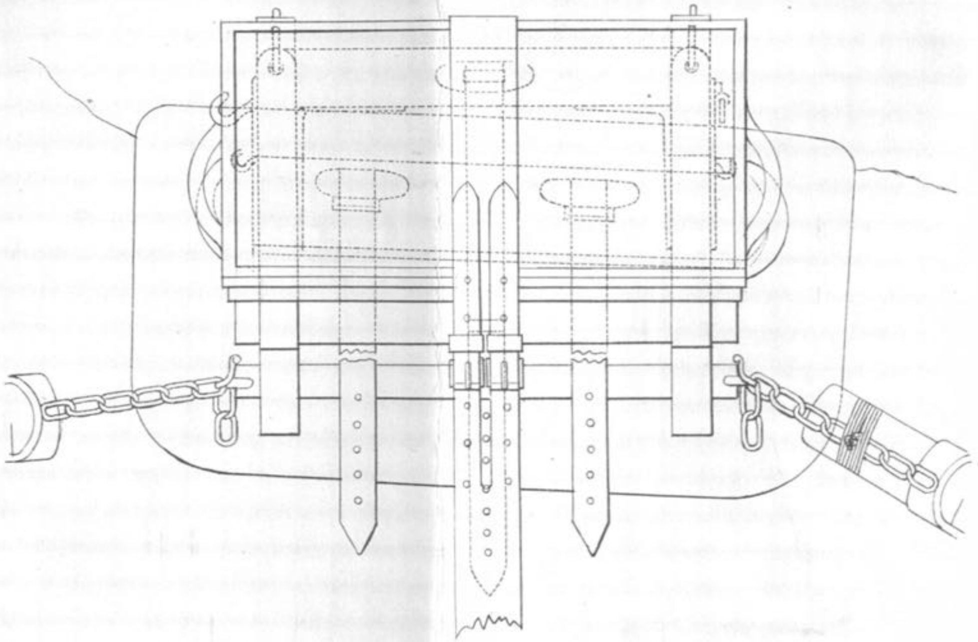


AXLETREE

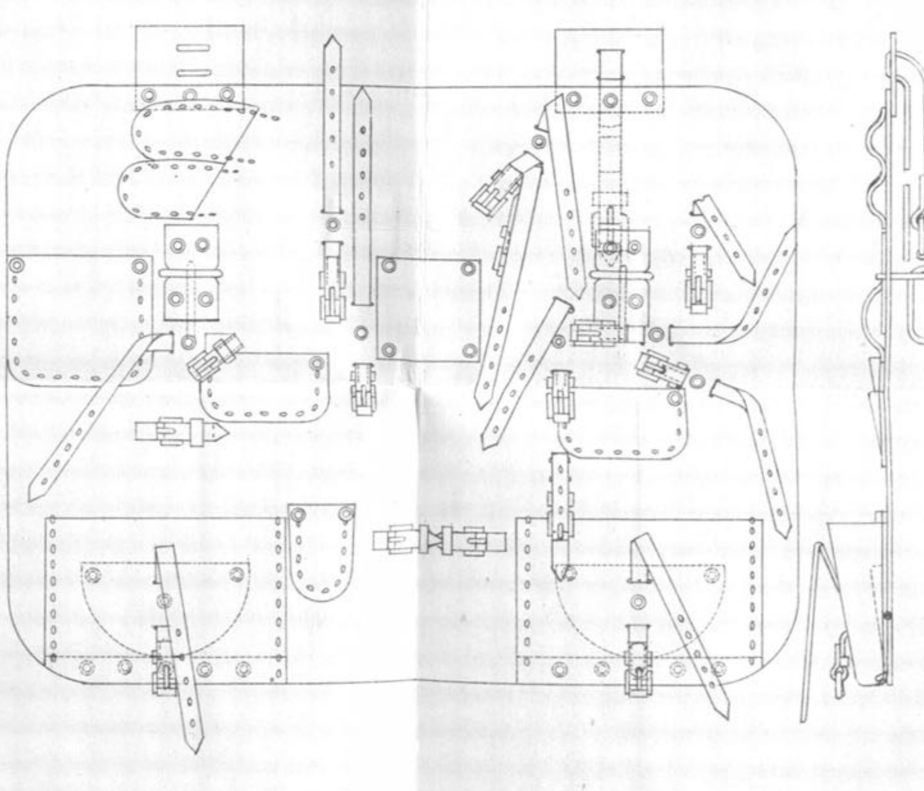


R.M.L. 2·5 INCH EQUIPMENT.

AMMUNITION.



RACK LEATHER ENTRENCHING TOOLS.



BOXES, R.M.L. 2·5-INCH.

